

Water-Related
Land Use
Inventories

Utah

*Cedar/Beaver
Study Unit*

A WATER-RELATED
LAND USE INVENTORY REPORT
of the
CEDAR/BEAVER BASIN

Aerial Photography and Field Mapping
Conducted in 1989

Prepared by

Utah Department of Natural Resources
Division of Water Resources

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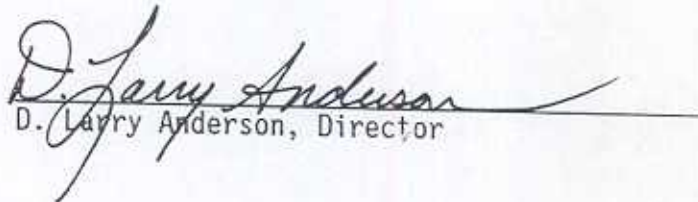

D. Larry Anderson, Director

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SUMMARY

This Water-Related Land Use Inventory Report of the Cedar/Beaver Basin is another in a series of land use reports prepared by the Division of Water Resources from data collected under its water-related land use inventory program. The land use inventory program of the division was set up to provide the land use data needed in the preparation of water budgets, hydrologic inventory reports and other state water planning activities. The division has collected land use data since 1966.

The water-related land use data for the Cedar/Beaver Basin were collected in 1989 by the Division of Water Resources. The report displays the data by subarea (see Figures 5 through 9) and tabulates it by subarea and county in Tables 2 and 3, respectively. The tables are presented in this summary as Tables i and ii, respectfully.

The division inventoried over 140,400 acres of land in the Cedar/Beaver Basin. This represents only about 3.9 percent of the entire Basin. Areas not inventoried are mainly rangeland and national forests. Of the inventoried acres, 110,813 were irrigated land (including land that was fallow, idle or sub-irrigated), 6,006 were wet/open water areas (including reservoirs), and 13,633 were residential/industrial areas (including farmsteads and rural housing).

In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agricultural lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are often not mapped. Acres shown for this category reflect only the number of acres mapped, not the number of acres that may be in this

Table i. Summary of land cover by subarea for the Cedar/Beaver Basin (acres).

Code	Cover	Beaver Subarea 06-01-001	Millford Subarea 06-01-002	Parowan Subarea 06-02-001	Cedar Subarea 06-02-002	Escalante Des. 06-03-001	Total
IA1a	Fruit	0	0	0	5	4	15
IA1e	Other Horticulture	0	0	0	0	0	0
IA2a	Grain	1,030	1,342	2,465	1,157	2,828	8,822
IA2al	Corn	259	1,669	1,101	373	179	2,581
IA2b	Vegetables	0	0	0	94	1	95
IA2b1	Potatoes	0	100	0	0	3,441	3,541
IA2b2	Onions	0	0	0	0	0	0
IA2b3	Beans	0	0	0	0	0	0
IA2c	Other Row Crops	0	0	0	0	0	0
IA3a	Alfalfa	7,270	15,559	12,267	8,021	24,068	67,185
IA3b	Grass Hay	1,397	0	168	276	124	1,965
IA3c	Grass/Turf	0	21	64	0	0	85
IA3d	Pasture	6,221	166	2,089	2,464	621	11,561
IA4a	Fallow	296	139	429	792	222	1,878
IA4b	Idle Overgrown	1,155	2,456	1,468	3,806	3,786	12,671
IIA1a	Pasture (surf. & sub.)	266	0	0	0	0	266
IIA1b	Grass Hay (surf. & sub.)	0	0	0	0	0	0
Surface Irr. Cropland Subtotal		17,894	21,452	19,057	16,988	35,274	110,685
IIA2a	Sub. Irr. Pasture	141	0	0	7	0	148
IIA2b	Sub. Irr. Grass Hay	0	0	0	0	0	0
Sub. Irr. Cropland Subtotal		141	0	0	7	0	148
Irrigated Croplands Subtotal		18,035	21,452	19,057	16,995	35,274	110,813
IIB-E	Cattail/Bullrush Aspect	0	0	0	0	0	0
IIIC	Wet/Vegetation Asp.	0	0	0	0	0	0
IIIE	Wet Flats	0	0	0	0	0	0
IIIF	Riparian	425	19	0	293	80	817
IIIF2	Open Water	1,251	8	2,342	65	371	4,037
IIIF2	Reservoirs	0	0	0	0	0	0
IIIF4a	Temporary Flooded	0	0	19	986	0	1,005
IIIF4b	Sewage Lagoon	45	13	56	0	0	114
IIIF4c	Evaporation Pond	0	33	0	0	0	33
Wet/Open Water Subtotal		1,721	73	2,417	1,344	451	6,006
VA	Farmsteads	385	437	357	874	541	2,594
VB	Residential	1,200	715	1,091	3,440	1,914	8,360
VB3	Open Spaces	81	87	58	192	12	430
VC	Commercial/Industrial	365	303	212	1,082	297	2,249
Residential/Industrial Subtotal		2,021	1,542	1,718	5,588	2,764	13,633
Land Use/Land Cover Totals		21,777	23,067	23,192	23,927	38,489	130,452

Table ii. Summary of land cover by county for the Cedar/Beaver Basin (acres).

Code	Cover	Beaver Co.	Iron Co.	Millard Co.	Washington Co.	Total
IA1a	Fruit	0	15	0	0	15
IA1e	Other Horticulture	0	0	0	0	0
IA2a	Grain	2,361	6,229	11	221	8,822
IA2a1	Corn	1,902	548	26	5	2,581
IA2b	Vegetables	0	94	0	1	95
IA2b1	Potatoes	100	3,250	0	191	3,541
IA2b2	Onions	0	0	0	0	0
IA2b3	Beans	0	0	0	0	0
IA2c	Other Row Crops	0	0	0	0	0
IA3a	Alfalfa	22,900	43,207	29	1,143	67,185
IA3b	Grass Hay	1,397	464	0	104	1,965
IA3c	Grass/Turf	21	64	0	0	85
IA3d	Pasture	6,305	4,790	82	384	11,561
IA4a	Fallow	435	1,368	0	75	1,878
IA4b	Idle Overgrown	3,379	8,603	232	457	12,671
IIA1a	Pasture (surf. & sub.)	266	0	0	0	266
IIA1b	Grass Hay (surf. & sub.)	0	0	0	0	0
Surface Irr. Cropland Subtotal		38,966	68,732	380	2,587	110,665
IIA2a	Sub. Irr. Pasture	141	7	0	0	148
IIA2b	Sub. Irr. Grass Hay	0	0	0	0	0
Sub. Irr. Cropland Subtotal		141	7	0	0	148
Irrigated Croplands Subtotal		39,107	68,739	380	2,587	110,813
II8-E	Cattail/Bullrush Aspect	0	0	0	0	0
II8	Wet/Vegetation Asp.	0	0	0	0	0
II9	Wet Flats	0	0	0	0	0
II9	Riparian	440	300	4	73	817
II9	Open Water	1,225	2,656	34	122	4,037
II9	Reservoirs	0	0	0	0	0
II9	Temporary Flooded	0	1,005	0	0	1,005
II9	Sewage Lagoon	58	56	0	0	114
II9	Evaporation Pond	33	0	0	0	33
Wet/Open Water Subtotal		1,756	4,017	38	195	6,006
VA	Farmsteads	812	1,735	10	37	2,594
V8	Residential	1,911	5,985	4	460	8,360
V83	Open Spaces	168	252	0	10	430
VC	Commercial/Industrial	658	1,554	0	37	2,249
Residential/Industrial Subtotal		3,549	9,526	14	544	13,633
Land Use/Land Cover Totals		44,412	82,282	432	3,326	130,452

category in the basin. Dry land agriculture (grain, beans, safflowers, etc.) represents only a small part of the total agriculture in this area of the state. The division mapped 1,339 acres under dry land agriculture in the Cedar/Beaver Basin.

This report also discusses the Division of Water Resources previous and present methodology of collecting and processing water-related land use data. It discusses the various land use classification codes used in past studies, and what is now considered the Standard Land Use Codes, which the division adopted in 1988 for all land use/land cover studies.

The information should be valuable to a variety of users, including county and city planners, state and federal agencies and private land owners. The division will use the data in water budget reports and in state water planning reports.

INTRODUCTION

The Division of Water Resources has been charged by the Utah State Legislature with the responsibility of developing a state water plan. This plan would coordinate and give direction to the activities of state and federal agencies concerned with Utah's water resources. To accomplish this objective, an assessment of the land use and available water resources is being made on a continuing basis. As a basis for planning and further development, the state has been divided into 11 natural drainage basins or study units shown in Figure 1. The South and East Colorado River Basin (originally designated basin No. 9) has been divided into the Southeast Colorado River Basin (retaining designation No. 9) and the Kanab Creek/Virgin River Basin (Lower Colorado River Basin), which is now basin No. 10.

While land use inventories contain information on land use in the state, water budget reports contain climate, hydrologic, and general information on the water resources within specific basins or study units. The water budgets provide an accounting of water inflow, outflow, yield, storage, evaporation, transpiration and uses in the study area. Hydrologic inventories and water budget reports currently published by the division are listed in Appendix A.

A major consideration in preparing water budgets is the quantity of water depleted through evaporation and transpiration. Estimates of these depletions are obtained by preparing water budgets from data gathered in the water-related land use inventories. This data includes the kinds and extent of irrigated crops, as well as similar information on phreatophytes, wet/open water areas and residential/industrial areas. Since 1966, the division has conducted water-related land use and hydrologic inventories in conjunction with other state water planning activities.

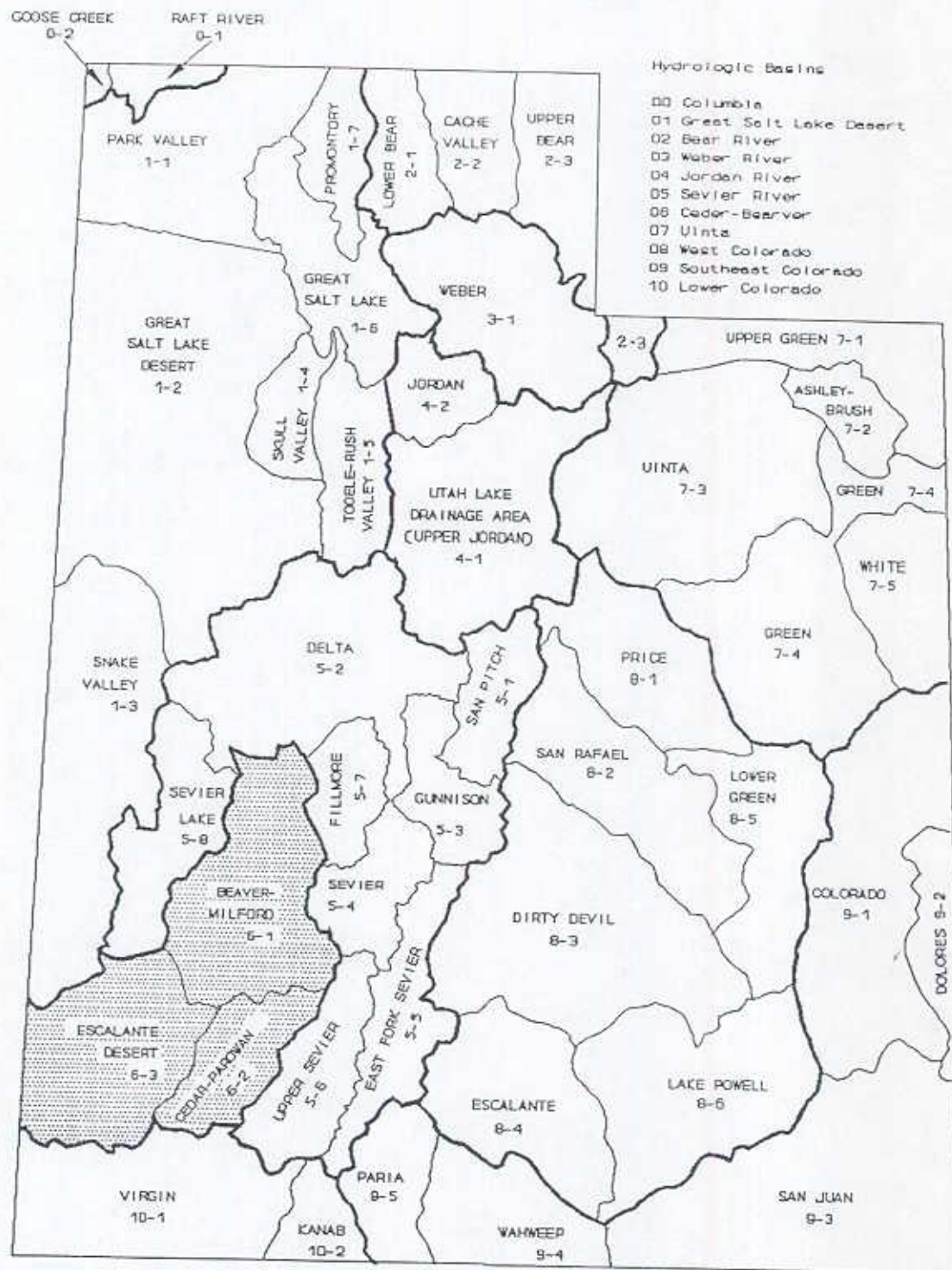


Figure 1. State of Utah hydrologic study areas with the Cedar/Beaver Study Unit highlighted.

This land use report should assist in promoting the coordinated and orderly development, conservation, use and management of water and land resources in the Cedar/Beaver Basin.

CEDAR/BEAVER STUDY UNIT WATER-RELATED LAND USE INVENTORY

The Cedar/Beaver Water-Related Land Use Inventory study unit was shown in Figure 1. Figure 2 shows the Cedar/Beaver Study Unit divided into separate hydrologic subareas. The study unit includes approximately 5,650 square miles of land lying between 37°30' to 39°07' latitude, and 122°30' to 114° 00' parallels, and includes Beaver County, most of Iron County and a small part of Washington County. Figure 3 shows the Cedar/Beaver Basin overlaid with a template showing the 7-1/2 min. USGS quadrangle maps used in the inventory. The state Automated Geographic Reference Center's (AGRC) reference numbers are cross-referenced with the division's reference number and the quadrangle name.

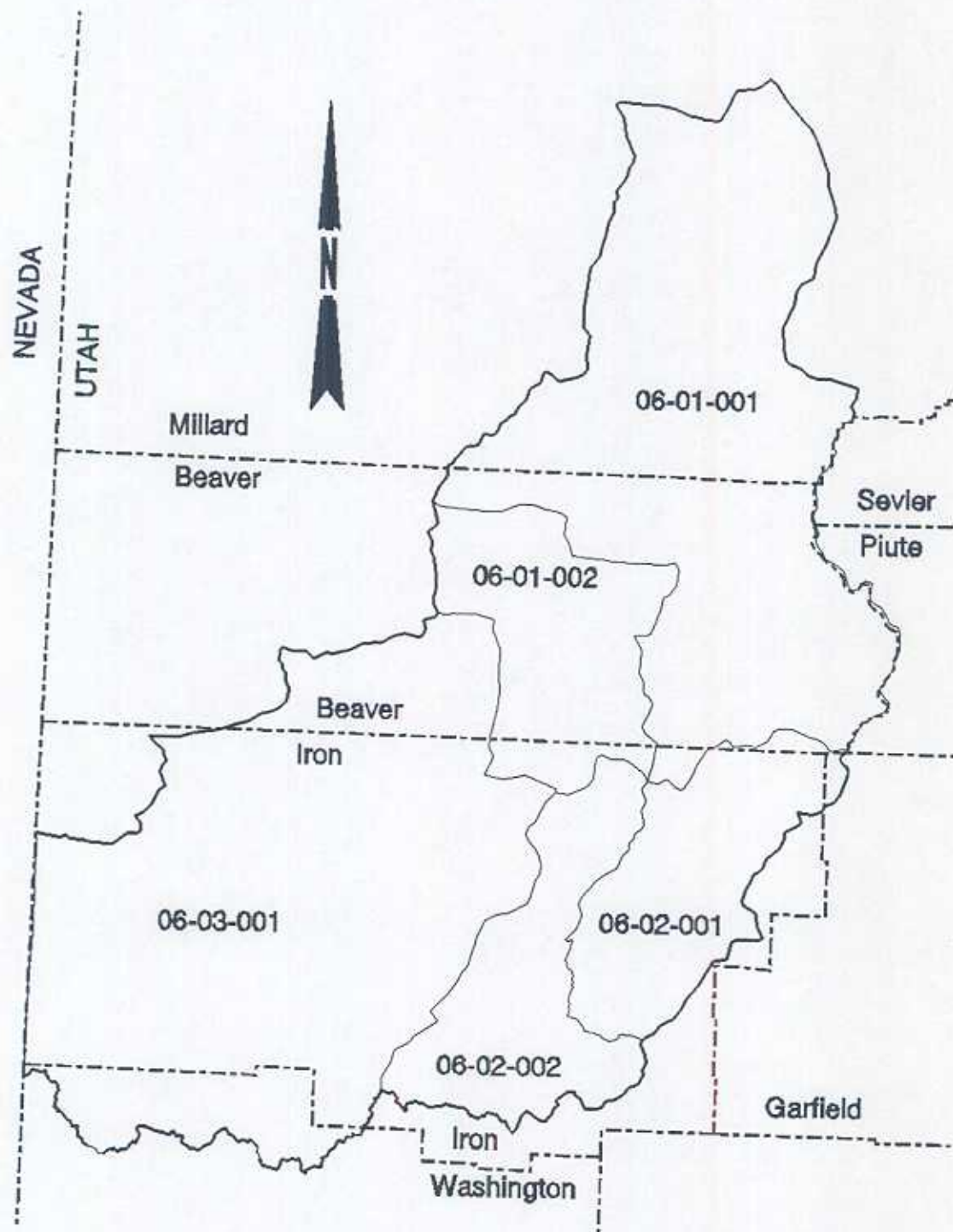


Figure 2. Hydrologic subareas of the Cedar/Beaver drainage area.

List of 7-1/2 Minute Quadrangles for Figure 3.

List No.	Quadrangle Name	AGRC No.	DWR No.	List No.	Quadrangle Name	AGRC No.	DWR No.
1	Rocky Knoll	2511	J-49	67	Bible Spring	3405	N-59
2	Pot Mountain	2512	J-50	68	Mountain Spring Peak	3406	N-60
3	Sunstone Knoll	2513	J-51	69	Lund	3407	N-61
4	Pavant Butte North	2514	J-52	70	Latimer	3408	N-62
5	Red Pass	2611	J-57	71	Badger Peak	3409	N-63
6	Neels	2612	J-58	72	Baboon Peak	3410	N-64
7	Clear Lake	2613	J-59	73	Dry Willow Peak	3411	O-57
8	Pavant Butte South	2614	J-60	74	Jack Henry Knoll	3412	O-58
9	The Sink	2615	J-61	75	Buckhorn Flat	3413	O-59
10	Candland Spring	2711	O-01	76	Burnt Peak	3414	O-60
11	Borden	2712	O-02	77	Fremont Pass	3415	O-61
12	Sand Ridge	2713	O-03	78	Deerlodge Canyon	3502	-08
13	Tabernacle Hill	2714	O-04	79	Eightmile Sprng	3503	S-01
14	Meadow	2715	O-05	80	Bannion Spring	3504	S-02
15	Cat Canyon	2811	O-09	81	Beryl	3505	S-03
16	Cruz	2812	O-10	82	Zane	3506	S-04
17	Black Point	2813	O-11	83	Avon NW	3507	S-05
18	Sixmile Point	2814	O-12	84	Avon	3508	S-06
19	Iron Mine Pass	2909	N-23	85	Enoch NW	3509	S-07
20	Red Rock Knoll	2910	N-24	86	Enoch NE	3510	S-08
21	Black Rock	2911	O-17	87	Parowan Gap	3511	T-01
22	Antelope Spring	2912	O-18	88	Paragonah	3512	T-02
23	Antelope Valley	2913	O-19	89	Cottonwood Mtn	3513	T-03
24	Dog Valley Peak	2914	O-20	90	Little Creek Peak	3514	T-04
25	Red Ridge	2915	O-21	91	Prohibition Flat	3602	-16
26	Frisco Peak	3008	N-30	92	Modena	3603	S-09
27	High Rock	3009	N-31	93	Heist	3604	S-10
28	Lime Mountain	3010	N-32	94	Yale Crossing	3605	S-11
29	Read	3011	O-25	95	Clark Farm	3606	S-12
30	Pinnacle Pass	3012	O-26	96	Antelope Peak	3607	S-13
31	Cinder Crater	3013	O-27	97	Avon SE	3608	S-14
32	Cove Fort	3014	O-28	98	The Three Peaks	3609	S-15
33	Trail Mountain	3015	O-29	99	Enoch	3610	S-16
34	Frisco	3108	N-38	100	Summit	3611	T-09
35	Milford NW	3109	N-39	101	Parowan	3612	T-10
36	Milford	3110	N-40	102	Red Creek Res.	3613	T-11
37	Ranch Canyon	3111	O-33	103	Fivemile Ridge	3614	T-12
38	Bearskin Mtn.	3112	O-34	104	Uvada	3702	-24
39	Gullies Hill	3113	O-35	105	Mount Escalante	3703	S-17
40	Pole Mountain	3114	O-36	106	Pinion Point	3704	S-18
41	Mount Belknap	3115	O-37	107	Beryl Junction	3705	S-19
42	Lamerdorf Peak	3206	N-44	108	Newcastle	3706	S-20
43	Frisco SW	3207	N-45	109	Silver Peak	3707	S-21
44	White Mountain	3208	N-46	110	Desert Mound	3708	S-22
45	Picaeho Peak	3209	N-47	111	Cedar City NW	3709	S-23
46	Milford Flat	3210	N-48	112	Cedar City	3710	S-24
47	Cave Canyon	3211	O-41	113	Flanigan Arch	3711	T-17
48	Adamsville	3212	O-42	114	Brian Head	3712	T-18
49	Beaver	3213	O-43	115	Panguitch Lake	3713	T-19
50	Black Ridge	3214	O-44	116	Pine Park	3802	-32
51	Shelly Baldy Peak	3215	O-45	117	Water Canyon Peak	3803	S-25
52	Delano Peak	3216	O-46	118	Hebron	3804	S-26
53	Pinto Spring	3304	N-50	119	Enterprise	3805	S-27
54	Observation Knoll	3305	N-51	120	Pinto	3806	S-28
55	The Tetons	3306	N-52	121	Page Ranch	3807	S-29
56	Blue Mountain	3307	N-53	122	Stoddard Mtn.	3808	S-30
57	Burns Knoll	3308	N-54	123	Kanarraville	3809	S-31
58	Thermo	3309	N-55	124	Cedar Mtn	3810	S-32
59	Ninemile Knoll	3310	N-56	125	Webster Flat	3811	T-25
60	Minersville	3311	O-49	126	Navajo Lake	3812	T-26
61	Minersville Res.	3312	O-50	127	Goldstrike	3903	S-33
62	Greenville Bench	3313	O-51	128	Maple Ridge	3904	S-34
63	Kane Canyon	3314	O-52	129	Central West	3905	S-35
64	Circleville Mtn.	3315	O-53	130	Central East	3906	S-36
65	Circleville	3316	O-54	131	Grass Valley	3907	S-37
66	Steamboat Mountain	3404	N-58				

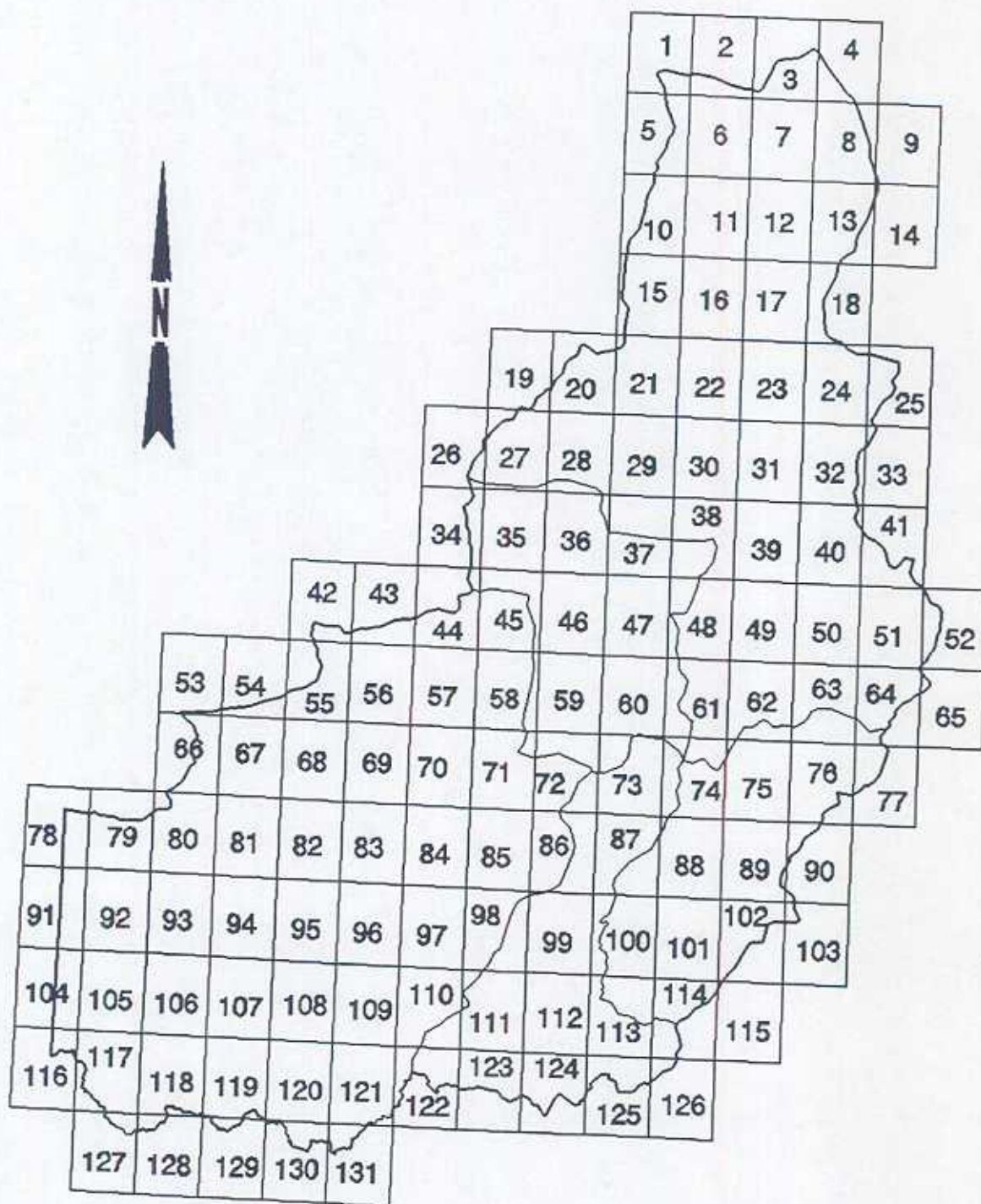


Figure 3. Cedar/Beaver Basin with hydrologic study area boundaries overlaid by a template showing 7-1/2 minute USGS quadrangle maps.

OPERATIONS USED IN LAND USE DATA ACQUISITION

Aerial Photography

Aerial photography of the study area was conducted from June to August 1989. Mapping & Analytical Photographic Services Inc., Salt Lake City, Utah, photographed the study area using a turbo-charged Cessna TU-206 aircraft specially modified for aerial photography. An ARNAV R-40 Loran C navigation system kept the plane on line, while a Nikon F-3 35mm camera with 24mm lens in the photo well took the photos. All slides were taken on 35mm Ektachrome film and processed by Kodak labs. Slides were identified according to flight line number, cross-referenced on a special location map, and delivered to the division at different times between June and August 1989. The actual flight date was written on each slide frame by the division. Approximately 500 slides were delivered to the division covering the water-related land use in the study unit. These slides may be viewed at, or copies purchased from, the offices of the Division of Water Resources, Planning Section, 1636 West North Temple, Salt Lake City, Utah.

Field Mapping and Checking

Transferring information from 35mm slides to the field maps was accomplished between June and August, 1989. Slide cataloging, filing and mapping were done concurrently. Field checking and mapping was completed between July 10, and September 1, 1989. This process involved six people from the Division of Water Resources and one from the U.S. Geological Survey.

Digitizing and Processing

The data resulting from digitizing the field maps was processed through the Utah State Automated Geographic Reference Center (AGRC) during the fall and winter of 1989-90. The Cedar/Beaver Basin data are maintained at both the AGRC and the Division of Water Resources. Maps and data can be obtained from the AGRC at the Office of Planning and Budget, State Office Building, Salt Lake City, Utah.

A draft map of the cropland cover types was printed for each 7-1/2 min. quad. map for the purpose of checking the data. Each map was laid over the corresponding field map on a light table, and the cropland types and boundaries were double-checked for accuracy. Any corrections or additions were marked in red on the draft map for future updating. The corrected maps were updated and stored on the AGRC system.

CEDAR/BEAVER BASIN LAND USE DATA

The list of cover types and codes used in the 1989 Water Related Land Use Inventory for the Cedar/Beaver Basin is shown in Table 1. This list was standardized in 1988 and is further discussed in the land use categories of this report. Figure 4 shows the general location of the water-related land use areas mapped in the Cedar/Beaver Study Unit. Figures 5-9 show the water-related land use for each hydrologic subarea. The explanation opposite each of these figures shows the land cover categories and the number of acres of land in each category.

Division policy is to publish its land use data in these types of reports. Detailed maps will not be included. With the establishment of the AGRC for the state of Utah, the division policy is to supply the land use data to them for further distribution. Detailed maps can be obtained from the AGRC.

Table 1. List of cover types and codes used in the 1989 Water-Related Land Use Inventory for the Cedar/Beaver Basin.

Code	Cover Type	Comments/Explanations
I	Cropland	(Rotation Crops)
IA	Irrigated Cropland	
IA1	Horticulture & Specialty Crops	
IA1a	Fruit	(Orchards)
IA1a1	Cherry	
IA1a2	Apple	
IA1a3	Peach	
IA1a4	Pear	
IA1a5	Apricot	
IA1a6	Other	
IA1b	Nuts	(Groves)
IA1b1	Walnut	
IA1b2	Pecan	
IA1b3	Other	
IA1c	Vineyard	(Grapes)
IA1d	Bush Fruit	
IA1e	Berries	
IA1f	Other Horticulture	(Nurseries)
IA1g	Other Specialty Crops	
IA2	Row and Close Grown Crops	
IA2a	Grain	
IA2a1	Corn	
IA2a2	Sorghum	
IA2a3	Wheat	
IA2a4	Barley	
IA2a5	Oats	
IA2a6	Other Grains	
IA2b	Vegetables	
IA2b1	Potatoes	
IA2b2	Onions	
IA2b3	Beans	
IA2b4	Tomatoes	
IA2b5	Sweet Corn	
IA2b6	Other	(Melons, Squash, Etc.)

Table 1. Continued.

Code	Cover Type	Comments/Explanations
IA3	Forage Crops	
IA3a	Alfalfa	
IA3b	Grass Hay	
IA3c	Grass/Turf	
IA3d	Pasture	(Turf Farms)
IA3e	Other	
IA4	Other	
IA4a	Fallow	(Plowed or disked.)
IA4b	Idle	(Overgrown more than one season.)
IB	Non-Irrigated Cropland	(Rotation Crops)
IB1	Row and Close-Grown Crops	
IB1a	Grain, Beans, Seeds	
IB1a1	Wheat	
IB1a2	Other Grains	(Barley, Etc.)
IB1a3	Dry Beans	
IB1a4	Safflower	
IB1a5	Other	
IB2	Hayland Crops	
IB2a	Alfalfa	
IB2b	Pasture	
IB2c	Other	
IB3	Other	
IB3a	Fallow	(Plowed, Stubble, Mulch)
IB3b	Idle	(Overgrown more than one season.)
II	Grassy/Phreato./Open Water Areas	
IIA	Grassy Aspect	
IIA2a	Irrigated	
IIA2a1	Pasture	(Subject to spring flooding.)
IIA2a2	Hayland	(Subject to spring flooding.)
IIA2b	Non-Irrigated	
IIA2b1	Pasture	(Receives subsurface water.)
IIA2b2	Hayland	(Receives subsurface water.)
IIA2c	Non-Agricultural Use	(Receives subsurface water.)
IIB	Cattail/Bulrush Aspect	

Table 1. Continued.

Code	Cover Type	Comments/Recommendations
IIC	Wet Flats	(Mud flats w/little or no vgtn.)
IID	Shrub Aspect	(Salt Brush, Sagebrush)
IIE	Riparian	
IIE1	Forested Aspect	(Cottonwoods, Birch)
IIE2	Shrub Aspect	(Willows)
IIF	Open Water	
IIF1	Streams	
IIF2	Reservoirs	(Man-Made)
IIF3	Ponds & Lakes	
IIF4	Other	
IIF4a	Temporary Flooded	
IIF4b	Sewage Lagoon	
IIF4c	Evaporation Pond	
III	Range Land and Forest Land	
IIIA	Alpine Plant Communities	
IIIB	Conifer	
IIIB1	Douglas Fir - White Fir	
IIIB2	Ponderosa Pine	
IIIB3	Fir - Spruce	
IIIB4	Lodgepole Pine	
IIIB5	Pinion Pine - Juniper	
IIIB6	Other	
IIIC	Deciduous	
IIIC1	Aspen	
IIIC2	Mountain Brush	(Oak Brush, Maples, Chaparral)
IIIC3	Other	
IIID	Grass Aspect	
IIID1	Dry Pastures - Improved	(Chained and reseeded)
IIID2	Native Grasses	
IIID3	Other	(Forbs)
IIIE	Shrub Aspect	
IIIE1	Northern Desert Shrub	
IIIE1a	Sagebrush	(Shadscale, Greasewood, Halogeton)

Table 1. Continued.

Code	Cover Type	Comments/Explanations
IIIE1b	Other	
IIIE2	Southern Desert Shrubs	
IIIE2a	Creosote Bush	
IIIE2b	Other	(Forbs, Annual Grasses)
IIIE3	Salt Desert Shrubs	
IIIE3a	Shascale	
IIIE3b	Greasewood	
IIIE3c	Saltbrush	
IIIE3d	Desert Molley	
IIIE3e	Other	(Halogeton)
IV	Barren Lands	
IVA	Bare Soil/Sand	
IVA1	Dry Salt Flats	
IVA2	Beaches	
IVA3	Sandy Areas Other Than Beaches	
IVA4	Other	(Desert Sand Dunes)
IVB	Rock Outcrops	
IVC	Excavated Lands	(Strip Mines, Quarries, Gravel Pits)
IVD	Other	
V	Built-Up Land	
VA	Farmsteads	
VA1	Buildings/Homes	
VA2	Open Spaces	(Feed Lots, Etc.)
VB	Residential	
VB1	Buildings/Homes	(High Density)
VB2	Buildings/Homes	(Low Density)
VB3	Open Spaces	(Parks, Golf Courses)
VB4	Idle Spaces	(Not Irrigated)
VC	Commercial/Industrial	
VC1	Commercial	
VC2	Industrial	
VC3	Open Spaces	
VD	Transportation, Communications, Utilities	
VE	Other	

Land Cover Area Summary for Figure 4.
Cedar/Beaver Study Unit.

State Code	Cover Type	Acres
IA1a	Fruit	15.90
IA2a	Grain	8,821.49
IA2a1	Corn	2,582.14
IA2b	Vegetables	94.71
IA2b1	Potatoes	3,540.10
IA3a	Alfalfa	67,185.75
IA3b	Grass Hay	1,964.37
IA3C	Grass/Turf	84.60
IA3d	Pasture	11,561.40
IA4a	Fallow	1,878.30
IA4b	Idle	12,671.02
IB1a	Grain/Beans/Seeds (dry)	396.87 ¹
IB2a	Alfalfa (dry)	149.66 ¹
IB2b	Pasture (dry)	5,973.96 ¹
IB3b	Fallow (dry)	22.08 ¹
IB3c	Idle (dry)	2,876.37 ¹
IIA1a	Pasture (surf. & sub irr.)	266.15
IIA2a	Pasture (sub-irr.)	147.85
IIE	Riparian	817.08
IIF	Open Water	4,036.31
IIF4a	Temporary Flooded	1,004.84
IIF4b	Sewage Lagoon	113.94
IIF4c	Evaporation Pond	33.44
IVC	Excavated Lands	567.31
VA	Farmsteads	2,593.77
VB	Residential	8,360.71
VB3	Open Spaces	429.24
VC	Commercial/Industr.	2,248.92
		<u>140,412.06</u>

¹In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the numbers of acres mapped, not the total numbers of acres in the subarea.

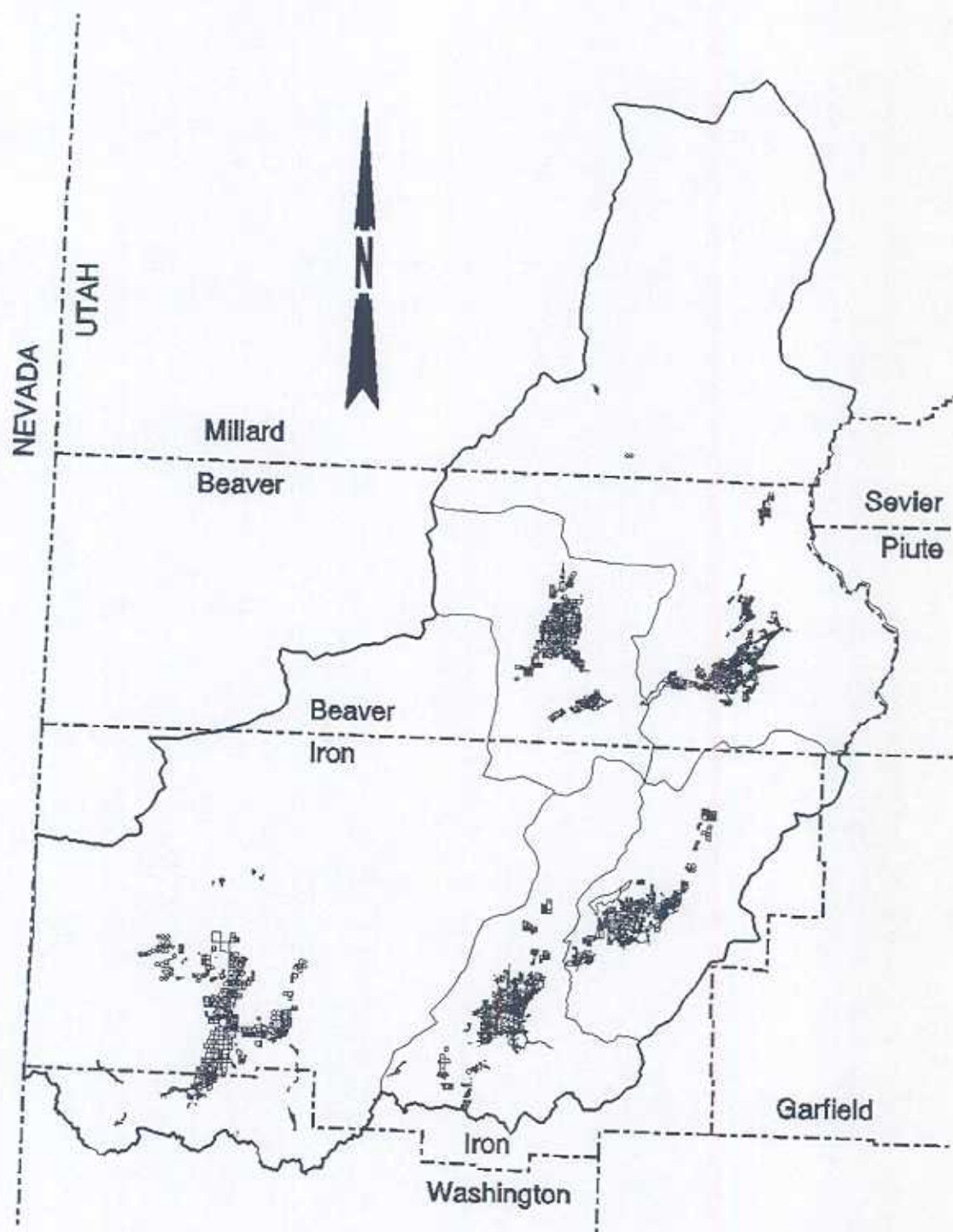


Figure 4. Water-related land use mapped areas for the Cedar/Beaver Basin.

Land Cover Area Summary for Figure 5.
Beaver (06-01-001) subarea.

Code	Land Cover	Acres
IA2a	Grain	1,029.72
IA2a1	Corn	259.66
IA3a	Alfalfa	7,270.79
IA3b	Grass Hay	1,396.51
IA3d	Pasture	6,221.21
IA4a	Fallow	246.40
IA4b	Idle	1,155.83
IIA1a	Pasture (surf & sub irr)	266.15
IIA2a	Pasture (sub irr)	140.68
IIE	Riparian Wetlands	425.35
IIF	Open Water	1,250.86
IIF4b	Sewage Lagoon	45.24
IVC	Excavated Lands	120.68
VA1	Farmsteads	54.93
VA2	Open Spaces (rural)	330.48
VB1	Residential (high density)	720.66
VB2	Residential (low density)	480.06
VB3	Open Spaces	80.77
VC	Commercial	354.57
		21,779.87

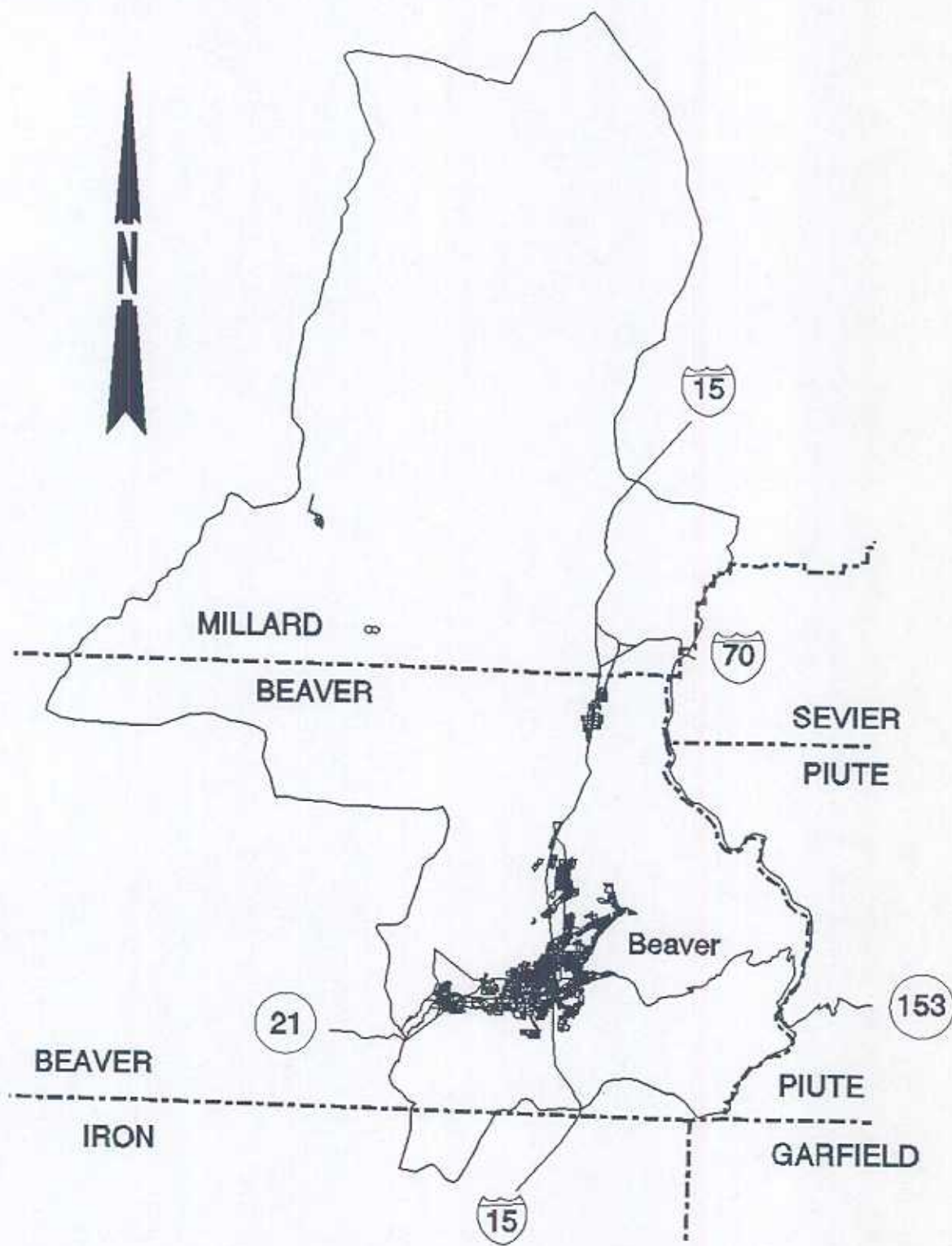


Figure 5. Water-related land use coverage of the Beaver subarea.

Land Cover Area Summary for Figure 6.
Milford (06-01-002) subarea.

Code	Land Cover	Acres
IA2a	Grain	1,342.14
IA2a1	Corn	1,669.20
IA2b1	Potatoes	99.51
IA3a	Alfalfa	15,558.90
IA3c	Turf	20.54
IA3d	Pasture	165.94
IA4a	Idle-Plowed	138.62
IA4b	Idle	2,455.55
IB2a	Alfalfa (Non Irr.)	45.61 ¹
IB2b	Pasture (Non Irr.)	116.95 ¹
IB3b	Idle (Non Irr.)	24.42 ¹
IIE	Riparian Wetlands	18.65
IIF	Open Water	8.26
IIF4b	Sewage Lagoon	13.07
IIF4c	Evaporation Pond	33.44
IVC	Excavated Lands	9.99
VA1	Farmsteads	20.48
VA2	Open Spaces (rural)	416.23
VB1	Bldgs/Homes (hi den)	254.28
VB2	Bldgs/Homes (lo den)	460.69
VB3	Open Spaces	86.96
VC	Commercial	150.44
VC2	Industrial	152.58
		23,262.45

¹In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the number of acres mapped, not the total number of acres in the subarea.

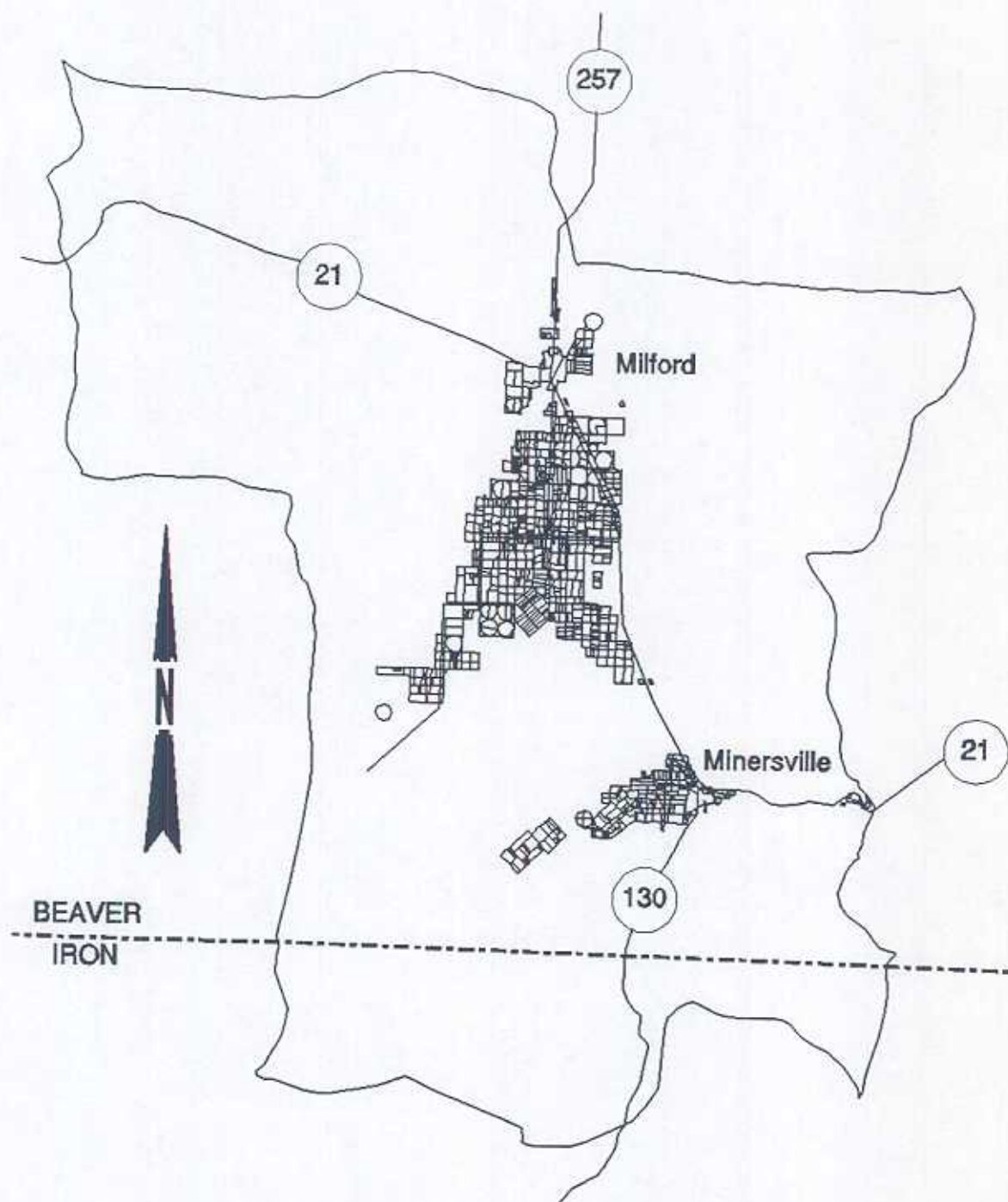


Figure 6. Water-related land use coverage of the Milford subarea.

Land Cover Area Summary for Figure 7.
Parowan (06-02-001) subarea.

Code	Land Cover	Acres
IA1a	Fruit	6.33
IA2a	Grain	2,464.86
IA2a1	Corn	100.83
IA3a	Alfalfa	12,267.03
IA3b	Grass Hay	167.78
IA3c	Turf	63.92
IA3d	Pasture	2,088.64
IA4a	Idle-Plowed	429.47
IA4b	Idle-Overgrown	1,468.33
IB2b	Pasture (Non Irr.)	1,410.57 ¹
IB3b	Idle (Non Irr.)	163.56 ¹
IIF	Open Water	2,341.59
IIF4a	Temporary Flooded	18.85
IIF4b	Sewage Lagoon	55.63
IVC	Excavated Lands	143.43
VA1	Farmsteads	275.44
VA2	Open Spaces (rural)	81.36
VB2	Residential (low den)	1,091.00
VB3	Open Spaces	57.70
VC1	Commercial	85.87
VC2	Industrial	2.46
VC3	Open Space	123.62
		24,908.27

¹In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the number of acres mapped, not the total number of acres in the subarea.

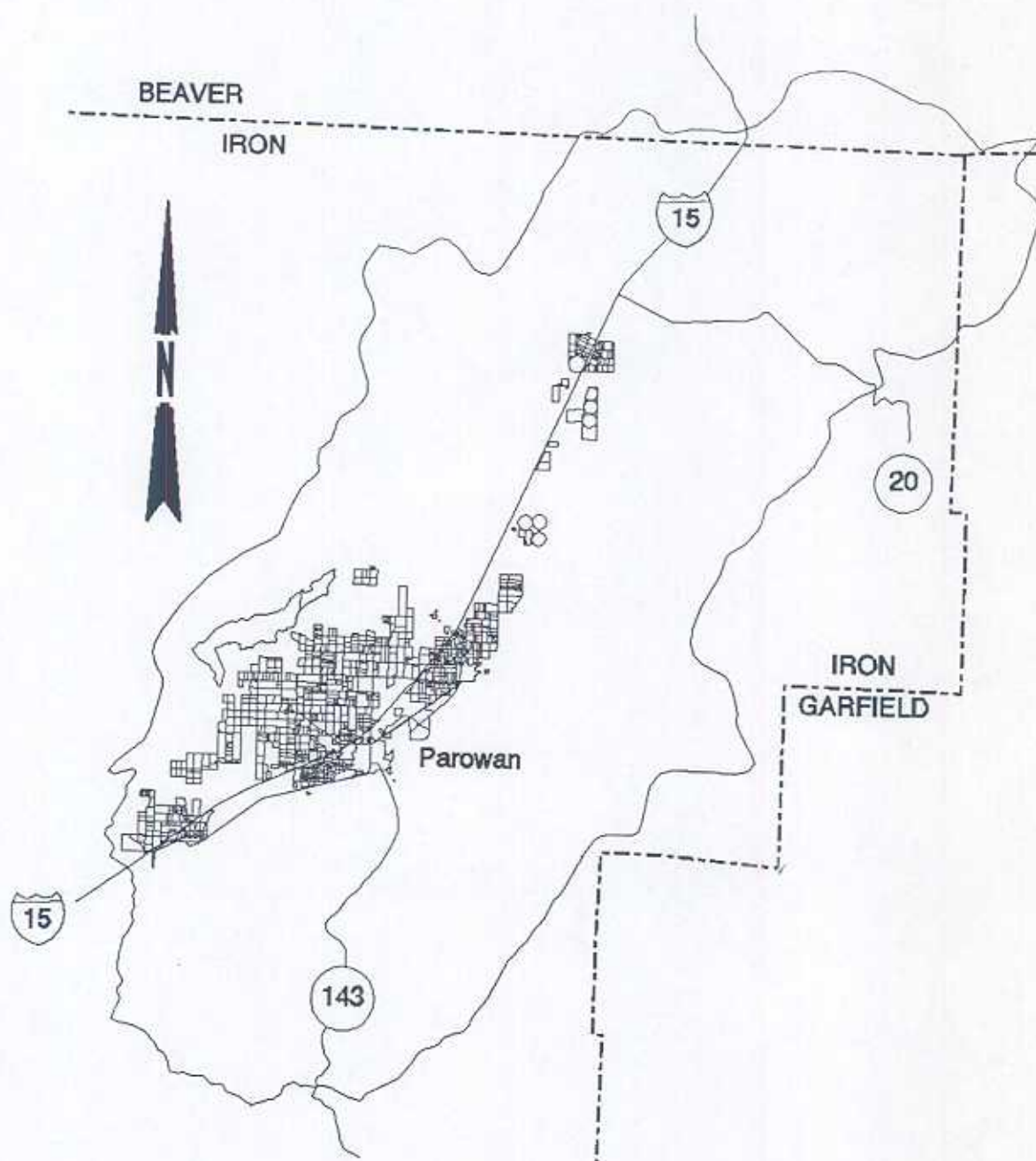


Figure 7. Water-related land use coverage of the Parowan subarea.

Land Cover Area Summary for Figure 8.
Cedar (06-02-002) subarea.

Code	Land Cover	Acres
IA1a	Fruit	4.86
IA2a	Grain	1,156.76
IA2a1	Corn	373.42
IA2b4	Tomatoes	94.04
IA3a	Alfalfa	8,021.16
IA3b	Grass Hay	275.99
IA3d	Pasture	2,464.47
IA4a	Fallow	791.60
IA4b	Idle	3,806.39
IB1a	Grain/Beans/Seeds (N.I.)	73.96 ¹
IB2b	Pasture (Non Irr.)	477.42 ¹
IB3a	Fallow (Non Irr.)	22.08 ¹
IB3b	Idle (Non Irr.)	936.82 ¹
IIA2a	Pasture (sub-irr.)	7.17
II E	Riparian	292.75
II F	Open Water	64.67
II4F4	Temporary Flooded	985.99
IVC	Excavated Lands	272.29
VA1	Farmsteads	544.91
VA2	Open Spaces (rural)	328.82
VB1	Residential (hi den)	1,779.88
VB2	Residential (lo den)	1,557.05
VB3	Open Spaces	191.97
VB4	Idle Spaces	103.28
VC1	Commercial	739.80
VC3	Open Spaces	341.98
		25,709.53

¹In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the number of acres mapped, not the total number of acres in the subarea.

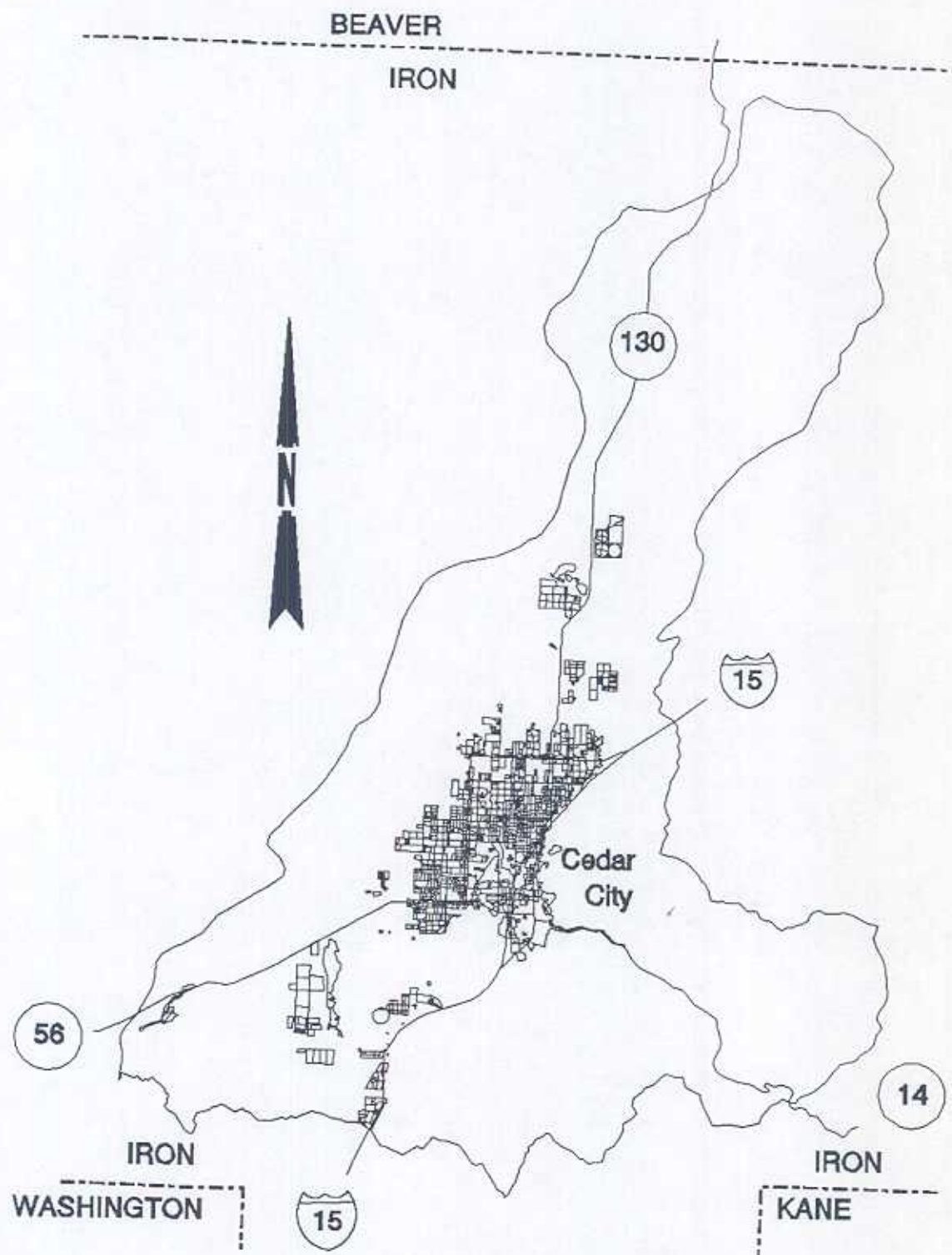


Figure 8. Water-related land use coverage of the Cedar subarea.

Land Cover Area Summary for Figure 9.
Escalante Desert (06-03-001) subarea.

Code	Land Cover	Acres
IA1a	Fruit	4.71
IA2a	Grain	2,828.01
IA2a1	Corn	179.03
IA2b	Vegetables	0.67
IA2b1	Potatoes	3,440.59
IA3a	Alfalfa	24,067.87
IA3b	Grass Hay	124.09
IA3c	Turf	0.14
IA3d	Pasture	621.14
IA4a	Fallow	222.21
IA4b	Idle	3,785.68
IB1a	Grain/Beans/Seeds (N.I.)	184.04 ¹
IB2a	Alfalfa (Non Irr.)	94.54 ¹
IB2b	Pasture (Non Irr.)	1,694.50 ¹
IB3b	Idle (Non Irr.)	1,751.57 ¹
IIE	Riparian	80.33
IIF	Open Water	370.93
IVC	Excavated Lands	20.92
VA1	Farmsteads	171.94
VA2	Open Spaces (rural)	369.18
VB	Residential	27.84
VB2	Residential (lo den)	596.65
VB3	Open Spaces	11.84
VB4	Idle Spaces	1,289.32
VC1	Commercial	240.68
VC3	Open Spaces	56.92
		<hr/> 42,235.34 <hr/>

¹In conducting water-related land use inventories, the division attempts to inventory all lands or areas that consume or evaporate water other than natural precipitation. Non-irrigated agriculture lands are generally mapped if they fall within or border irrigated lands. Non-irrigated lands away from irrigated lands are normally not mapped. Acres shown in the table reflect only the number of acres mapped, not the total number of acres in the subarea.

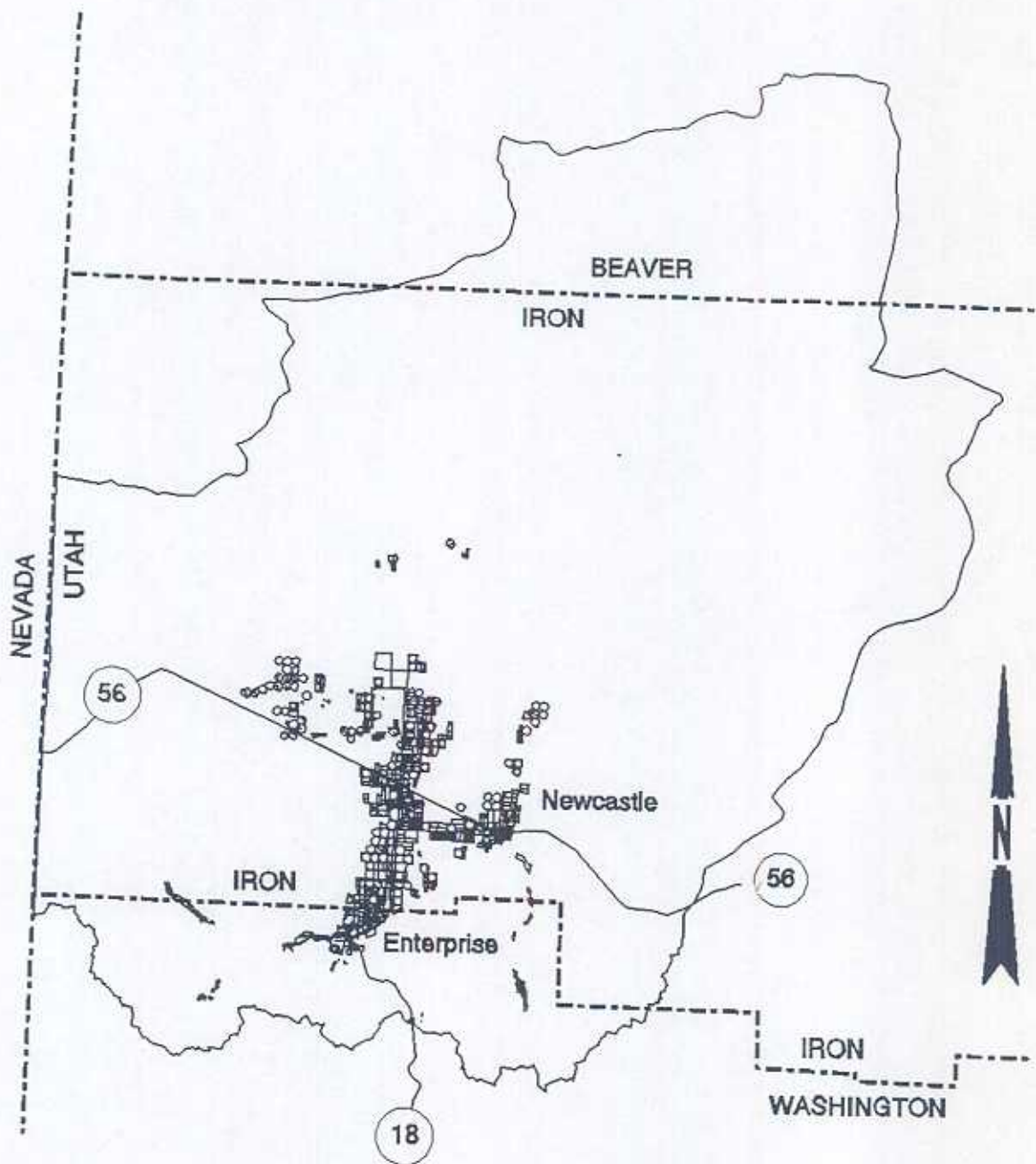


Figure 9. Water-related land use coverage of the Escalante Desert Subarea.

The water-related land cover for all the subareas in the study area is summarized in Table 2, and water-related land cover for the counties is summarized in Table 3.

The division inventoried over 140,400 acres of land in Beaver, Iron, Millard and Washington counties. This amounts to 3.9 percent of the entire land area in the Cedar/Beaver Basin. Areas not inventoried are mainly national forests and rangeland. Of the inventoried acres, 110,813 are irrigated land (including land that is fallow, idle or sub-irrigated), 6,006 are wet/open water areas (including reservoirs) and 13,633 are residential/industrial areas (including farmsteads and rural housing).

Table 2. Summary of land cover by subarea for the Cedar/Beaver Basin (acres).

Code	Cover	Beaver Subarea 06-01-001	Milford Subarea 06-01-002	Parowan Subarea 06-02-001	Cedar Subarea 06-02-002	Escalante Des. 06-03-001	Total
IA1a	Fruit	0	0	0	5	4	15
IA1e	Other Horticulture	0	0	0	0	0	0
IA2a	Grain	1,030	1,342	2,465	1,157	2,828	8,822
IA2a1	Corn	259	1,669	101	373	179	2,581
IA2b	Vegetables	0	0	0	94	1	95
IA2b1	Potatoes	0	100	0	0	3,441	3,541
IA2b2	Onions	0	0	0	0	0	0
IA2b3	Beans	0	0	0	0	0	0
IA2c	Other Row Crops	0	0	0	0	0	0
IA3a	Alfalfa	7,270	15,559	12,267	8,021	24,068	67,185
IA3b	Grass Hay	1,397	0	168	276	124	1,965
IA3c	Grass/Turf	0	21	64	0	0	85
IA3d	Pasture	6,221	166	2,089	2,464	621	11,561
IA4a	Fallow	296	139	429	792	222	1,878
IA4b	Idle Overgrown	1,155	2,456	1,468	3,806	3,786	12,671
IA1a	Pasture (surf. & sub.)	266	0	0	0	0	266
IA1b	Grass Hay (surf. & sub.)	0	0	0	0	0	0
Surface Irr. Cropland Subtotal		17,894	21,452	19,057	16,988	35,274	110,685
IIA2a	Sub. Irr. Pasture	141	0	0	7	0	148
IIA2b	Sub. Irr. Grass Hay	0	0	0	0	0	0
Sub. Irr. Cropland Subtotal		141	0	0	7	0	148
Irrigated Croplands Subtotal		18,035	21,452	19,057	16,995	35,274	110,813
IIB	Cattail/Bullrush Aspect	0	0	0	0	0	0
IIB-E	Wet/Vegetation Asp.	0	0	0	0	0	0
IIC	Wet Flats	0	0	0	0	0	0
IIE	Riparian	425	19	0	293	80	817
IIF	Open Water	1,251	8	2,342	65	371	4,037
IIF2	Reservoirs	0	0	0	0	0	0
IIF4a	Temporary Flooded	0	0	19	986	0	1,005
IIF4b	Sewage Lagoon	45	13	56	0	0	114
IIF4c	Evaporation Pond	0	33	0	0	0	33
Wet/Open Water Subtotal		1,721	73	2,417	1,344	451	6,006
VA	Farmsteads	385	437	357	874	541	2,594
VB	Residential	1,200	715	1,091	3,440	1,914	8,360
VB3	Open Spaces	81	87	58	192	12	430
VC	Commercial/Industrial	355	303	212	1,082	297	2,249
Residential/Industrial Subtotal		2,021	1,542	1,718	5,588	2,764	13,633
Land Use/Land Cover Totals		21,777	23,067	23,192	23,927	38,489	130,452

Table 3. Summary of land cover by county for the Cedar/Beaver Basin (acres).

Code	Cover	Beaver Co.	Iron Co.	Millard Co.	Washington Co.	Total
IA1a	Fruit	0	15	0	0	15
IA1e	Other Horticulture	0	0	0	0	0
IA2a	Grain	2,361	6,229	11	221	8,822
IA2a1	Corn	1,902	648	26	5	2,581
IA2b	Vegetables	0	94	0	0	94
IA2b1	Potatoes	100	3,250	0	191	3,541
IA2b2	Onions	0	0	0	0	0
IA2b3	Beans	0	0	0	0	0
IA2c	Other Row Crops	0	0	0	0	0
IA3a	Alfalfa	22,800	43,207	29	1,149	67,185
IA3b	Grass Hay	1,397	464	0	104	1,965
IA3c	Grass/Turf	21	64	0	0	85
IA3d	Pasture	6,305	4,790	82	384	11,561
IA4a	Fallow	435	1,368	0	75	1,878
IA4b	Idle Overgrown	3,379	8,603	232	457	12,671
IIA1a	Pasture (surf. & sub.)	266	0	0	0	266
IIA1b	Grass Hay (surf. & sub.)	0	0	0	0	0
Surface Irr. Cropland Subtotal		36,966	68,732	380	2,587	110,665
IIA2a	Sub. Irr. Pasture	141	7	0	0	148
IIA2b	Sub. Irr. Grass Hay	0	0	0	0	0
Sub. Irr. Cropland Subtotal		141	7	0	0	148
Irrigated Croplands Subtotal		39,107	68,739	380	2,587	110,813
IIB	Cattail/Bullrush Aspect	0	0	0	0	0
IIB-E	Wet/Vegetation Asp.	0	0	0	0	0
IC	Wet Flats	0	0	0	0	0
IE	Riparian	440	300	4	73	817
IF	Open Water	1,225	2,656	34	122	4,037
IF2	Reservoirs	0	0	0	0	0
IF4a	Temporary Flooded	0	1,005	0	0	1,005
IF4b	Sewage Lagoon	58	56	0	0	114
IF4c	Evaporation Pond	33	0	0	0	33
Wet/Open Water Subtotal		1,756	4,017	38	195	6,006
VA	Farmsteads	812	1,735	10	37	2,594
VB	Residential	1,911	5,985	4	460	8,360
VB3	Open Spaces	168	252	0	10	430
VC	Commercial/Industrial	658	1,554	0	37	2,249
Residential/Industrial Subtotal		3,549	9,526	14	544	13,633
Land Use/Land Cover Totals		44,412	82,282	432	3,326	130,452

METHODOLOGY FOR GATHERING LAND USE DATA

Background

The methodology used by the division over the past 25 years in conducting water-related land use studies has varied with regard to the procedures used, detail, etc. Earlier inventories were prepared with large format vertical-aerial photographs supplemented with field surveys to label boundaries, vegetation types, and other water use information.

After identifying crops and labeling photographs, the photographs were projected onto a base map and then planimetered or "dot-counted" to determine the acreage. Tables for individual townships and ranges were prepared showing total land within every section and the amount of land in each land use category. Data were then available for use in preparing water budgets.

The water-related land use inventories completed by the division and the U.S. Soil Conservation Service (SCS) over the last 25 years have essentially covered the entire state. The two agencies have inventoried about 4 million acres (including 1.4 million acres of irrigated land) in order to acquire the data needed to prepare hydrologic inventories and to conduct other water-related studies in Utah.

In the early 1980s, the division began updating its methodology for collecting water-related land use data to take advantage of the rapidly growing fields of remotely sensed data and computerized Geographic Information Systems (GIS). Updating land use data for each hydrologic area of the state is an on-going process, and the division has now developed procedures for consistent data gathering and for updating it at 7- to 10-year intervals.

For several years, the division contracted with the University of Utah Research Institute, Center for Remote Sensing and Cartography (CRSC), to prepare water-related land use inventories. During this period, water-related land use data was obtained by using high altitude color infrared photography and laboratory interpretation, with field checking. More recently, the division has entered into cooperative agreements with several federal and other state agencies to complete and update all land use data for the state of Utah.

Present Method

In March 1984, several division staff members visited the California Department of Water Resources to observe its methodology for collecting water-related land use data for state water planning purposes. The division, based on its review of the California methodology and its own experience, developed a water-related land use inventory program. This program includes the use of 35mm slides, USGS 7-1/2 minute quadrangle maps, field-mapping using base maps produced from the 35mm photography and a computerized geographic information system to process, store and retrieve land use data.

The first step in a water-related land use inventory is to identify areas to be covered with aerial photography for any individual year. These areas are identified on maps of suitable scale (usually 1:100,000) using previous land use studies and other available information such as maps generated from high altitude color infrared photography or Landsat. Flight lines are plotted on the maps show land areas to be covered with aerial photography. Flight lines are generally plotted running north and south through the center of the sections to be photographed. An exception to the

practice is a long narrow canyon with irrigated land only in the bottom. When this situation is encountered, the flight line will follow the canyon without regard to section lines or compass directions.

During the second step, identified areas are photographed using 35mm slide film. Ideally, the 35mm photography should be conducted at a time of year that shows the highest contrast between the water-related land use areas (mainly irrigated land) and surrounding areas. When field mapping/checking is to be conducted in the same season, the photographs are taken as early in the growing season as possible. The division has generally found that the period from June 15 to July 15 is the best time for this photography. The division specifies that aerial photographs be obtained using an aircraft (Figure 10) carrying a high quality 35mm single lens reflex camera mounted to focus along a vertical axis to the earth. A 24mm lens is required and photos must be taken between 6,000 and 6,500 feet above the ground. This procedure allows each slide to cover a little more than one square mile with approximately 30 percent overlap on the wide side of the slide and 5 percent on the slide's narrow side. High quality commercial color positive film is used with appropriate commercial processing after each day's flight. The slides are then cataloged according to the flight-line number and shown on a location map. All 35mm slides are stored in files at the division offices and cataloged according to individual quadrangle map location.

After cataloging the slides, the division transfers boundaries of water-related areas from the slide to USGS 7-1/2 minute quadrangle maps using a standard slide projector with a 100-200mm zoom lens. The image is directed from the projector, located below a glass table top, to a 45 degree first surface mirror to the back of a quadrangle map. The image showing through

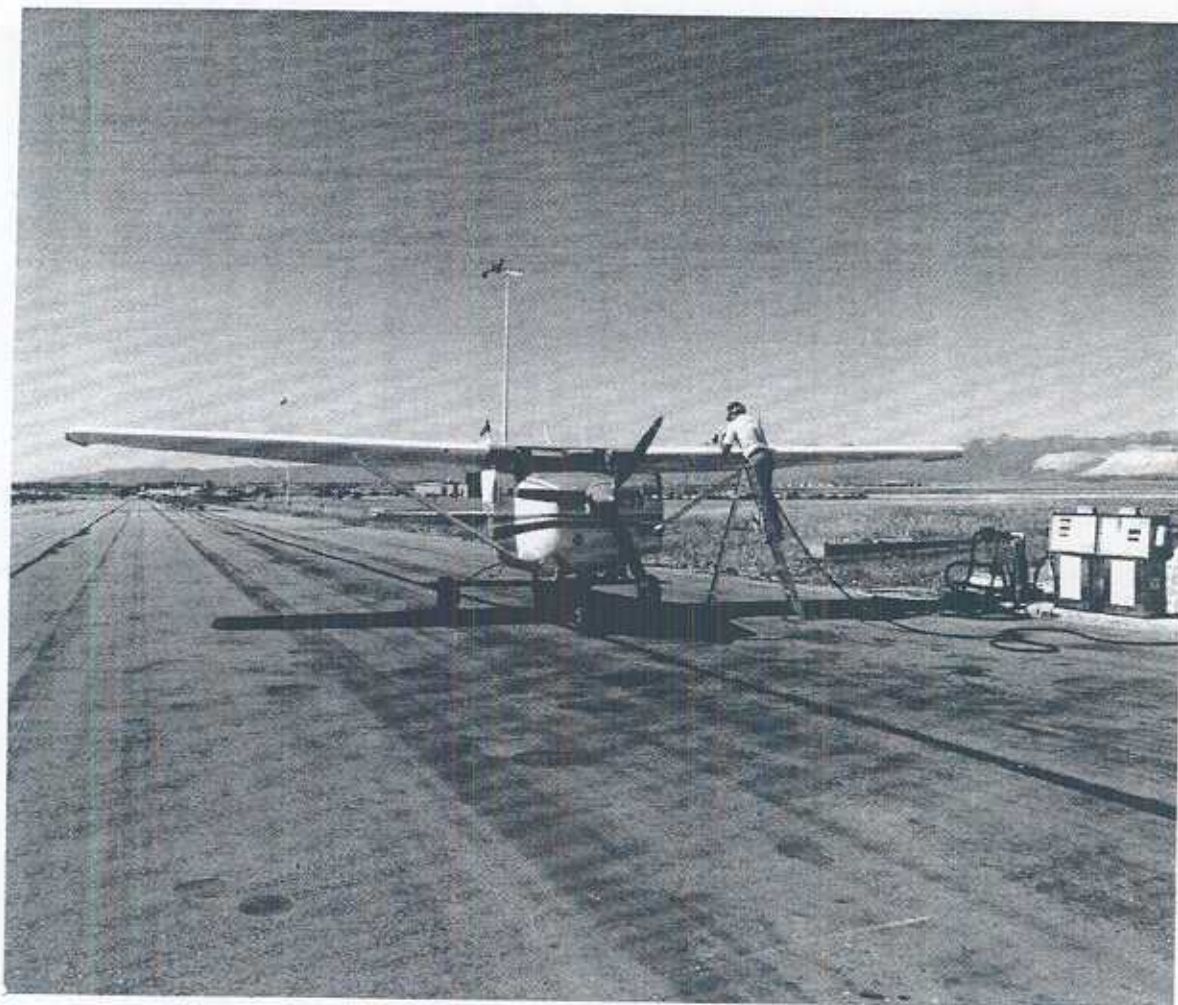


Figure 10. Typical aircraft used for aerial photography.

the map is adjusted to the map scale with the zoom lens. Field boundaries and other water-use boundaries are then traced on the 7-1/2 minute quadrangle map. At the same time, a technician attempts to identify the category of land use or land cover and uses a code for the appropriate category in each water use area on the field map. The date that transfer of slide data was completed is also noted on the map. Figure 11 illustrates this basic procedure.



Figure 11. Mapper transferring slide data to field map.

After the slide data are transferred to the quadrangle map, a two-person team uses the map in the field to check the boundaries and land use data on the quadrangle and marks in red the actual land use or land cover category if it is different than the category originally identified. After the land classification on the quadrangle map has been field-checked, the field team marks the completion date on the edge of the map. Figure 12 shows a Division of Water Resources field map after field-checking has been completed.

The next step is to digitize and process the field data. Digitizing is the process of converting data from map or image form to digital form for computer analysis. Typically, digitizing and entering the categories of land use into the computer is performed during the fall and winter following the aerial photography. This is accomplished by using ESRI ARC/INFO Software and a digitizer board large enough to hold a quadrangle map. The division's digitizing work station is shown in Figure 13. All processed data is filed in the State AGRC database. The division uses the special data management and geographic information management capabilities of the AGRC ARC/INFO system to produce tabulated water-related land use maps.



Figure 13. Digitizing work station.

Once the land use data have been digitized and processed through the AGRC ARC/INFO system, the division plots out a 7-1/2 minute quadrangle line map of the data. These plots are overlaid on the field maps to check for errors in recording or digitizing. An example of a line map of the Beaver quadrangle is shown in Figure 14.

Computer-Generated Line Maps Legend for Figure 14.
Cedar/Beaver Study Unit.

Label	Code	Cover Type
O	IA1a	Orchards
BR	IA1e	Berries
G	IA2a	Grain
C	IA2a1	Corn
V	IA2b	Vegetables
PO	IA2b1	Potatoes
ON	IA2b2	Onions
B	IA2b3	Beans
T	IA2b4	Tomatoes
S	IA2c	Other Row Crops
A	IA3a	Alfalfa
P1	IA3b	Grass Hay
P	IA3d	Pasture
TF	IA3e	Turf/Grass Yards
F	IA4a	Idle-Plowed
I	IA4b	Idle-Overgrown
DG	IB1a	Non Irr. Crops
DA	IB2a	Non Irr. Alfalfa
DP	IB2b	Non Irr. Pasture
DF	IB3a	Non Irr. Idle-Plowed
DI	IB3b	Non Irr. Idle-Overgrown
IWP	IIA2a1	Irrigated Wet Pasture
IWP1	IIA2a2	Irrigated Wet Grass Hay
WP	IIA2b1	Wet Pasture/Non Irr.
WP1	IIA2b2	Non Irr. F.W. Hay Land
WF	IIC	Wet Flats
WR	IIB	Cattail/Bulrush
W	IIF	Open Water
WM	IIF4a	Temp. Flooded/Marsh
SL	IIF4b	Sewage Lagoons
EP	IIF4c	Evaporation Pond
R	VB1	Buildings/Homes
R2	VB2	Buildings/Homes
RP	VB3	Open Spaces
R	VB6a	Residential
CM	VC1	Commercial
CI	VC2	Industrial
CS	VC3	Open Spaces

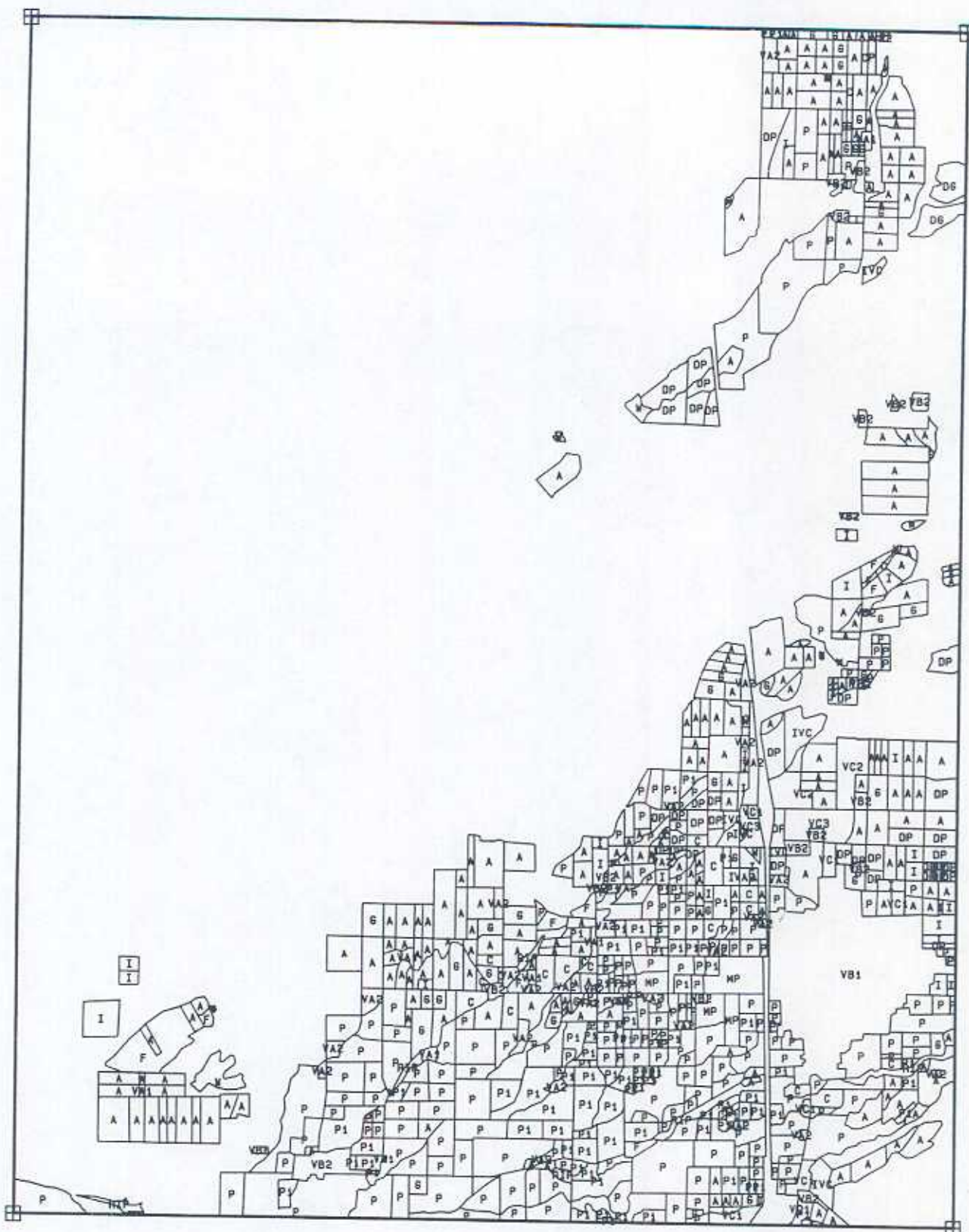




































Figure 14. Computer-generated line map of the Beaver 7-1/2 minute quadrangle.

Once checked, the data in the AGRC ARC/INFO system become available for use in water resource planning studies. A map of the Beaver quadrangle, similar to what might be obtained from the AGRC, is shown in Figure 15.

Legend for computer generated color map Figure 15.

	IA1a	FRUIT	IRRIG. CROPLAND
	IA1e	BERRIES	
	IA2a	GRAIN	
	IA2a1	CORN	
	IA2a2	SORGHUM	
	IA2b	VEGETABLES	
	IA2b1	POTATOES	
	IA2b2	ONIONS	
	IA2b3	BEANS	
	IA2c	OTHER ROW CROPS	
	IA3a	ALFALFA	
	IA3b	GRASS HAY	
	IA3c	GRASS/TURF	
	IA3d	PASTURE	
	IA4a	FALLOW	
	IA4b	IDLE	
	IIA1a	PASTURE	GRASSY/PHREATO.
	IIA1b	HAYLAND	
	IIA2a	PASTURE	
	IIA2b	HAYLAND	
	IB	NON IRR. CROPLAND	NON-IRRIG. CROPLAND
	IB1a	GRAIN	
	IB2a	ALFALFA	
	IB2b	PASTURE	
	IB3a	FALLOW	
	IB3b	IDLE	
	IIC	WET FLATS	GRASSY/PHREATO./WATER
	IIE	RIPARIAN	
	IIF	OPEN WATER	
	IIF4a	TEMP. FLOODED	
	IIF4b	SEWAGE LAGOON	BUILT-UP LAND
	VB	RESIDENTIAL	
	VB4	OPEN SPACES	
	VC	COMMERCIAL/INDUSTR.	

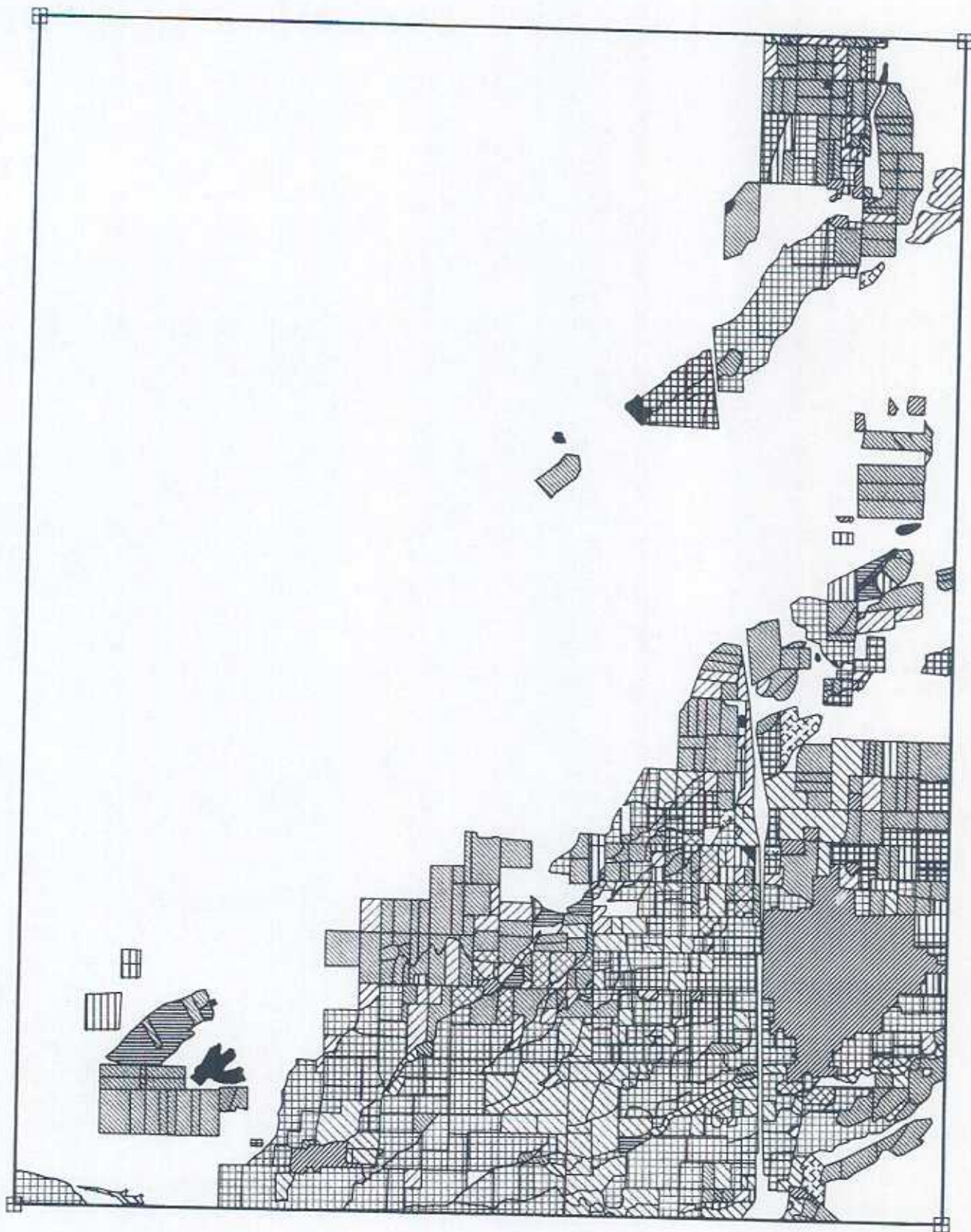


Figure 15. Final computer-generated map of the Beaver 7-1/2 minute quadrangle.

LAND USE CATEGORIES

During the division's years of collecting water-related land use data, land use categories and map codes have varied from inventory to inventory.

In late 1984, at the beginning of the division's new phase of mapping water-related land use, an Active Mappers Committee was formed. The committee reviewed all ongoing mapping efforts in the state and then focused on the issue of coordinating and standardizing map data. A summary of the committee's work is given in Appendix B. The division is committed to using the *1988 Standard Cover Types and Codes List* developed from this committee. Codes from this standard cover type list, with descriptive information, are shown in Table 1.

As each water-related land use inventory for the state is completed and, also, when some areas are re-inventoried, it is useful in some instances to tabulate and compare inventories and respective changes. Because of the different names of cover type and codes that were used earlier to the *1988 Standard Cover Types and Codes List*, it becomes necessary that earlier names of cover types and codes should be provided in this report. Table 4 shows the codes from earlier studies that relate to the standard cover types. Appendix C lists the previous land use studies conducted by the division.

Table 4. List of cover types and land use codes (standardized in 1988) for the State of Utah with the state code and comparisons of the 1988 standard code and cover type to previous land use inventories.

STATE CODE	COVER TYPES (Standardized in 1988)	UTAH LK. (66)* BEAR R. (69) WEBER R. (70)	UINTAH (67) W. COLO. (67) VIRGIN R. (78) UINTA B. (80)	SALT LAKE COUNTY (82)	U. SEVIER (81) M. SEVIER (83) L. SEVIER (85) BEAR R. (86) WEBER R. (87)
I	Cropland	- ^b	-	-	* ^c
IA	Irrigated	A ^d	A	-	*
IA1	Hort. & Specialty Crops	-	-	-	*
IA1a	Fruit	A8	A16	-	*
IA1a1	Cherry	-	-	-	*
IA1a2	Apple	-	-	-	*
IA1a3	Peach	-	-	-	*
IA1a4	Pear	-	-	-	*
IA1a5	Apricot	-	-	-	*
IA1a6	Other	-	-	-	*
IA1b	Nuts	-	-	-	*
IA1b1	Walnut	-	-	-	*
IA1b2	Pecan	-	-	-	*
IA1b3	Other	-	-	-	*
IA1c	Vineyard	-	-	-	*
IA1d	Bush Fruit	-	-	-	*
IA1e	Berries	-	-	-	*
IA1f	Nurseries	-	-	-	*
IA1g	Other	-	-	-	*
IA2	Row & Close-Grown Crops	-	-	-	*
IA2a	Grain	A4	-	-	*
IA2a1	Corn	A5	A1	Ag	*
IA2a2	Sorghum	-	-	-	*
IA2a3	Wheat	-	A9	-	*
IA2a4	Barley	-	A7	-	*
IA2a5	Oats	-	A8	-	*
IA2a6	Other	-	-	-	*
IA2b	Vegetables	-	-	-	*
IA2b1	Potatoes	A7	A3	-	*
IA2b2	Onions	-	-	-	*
IA2b3	Beans	A13	-	-	*
IA2b4	Tomatoes	A10	A5	-	*
IA2b5	Sweet Corn	-	-	-	*
IA2b6	Other	A6,A9,A11	A2,A4,A6	-	IA2b5 ^e

* The data in parentheses (66) identifies the year the field checking was conducted for the various inventories.

^b The dash (-) indicates that there was no corresponding cover type mapped for the above inventories.

^c The asterisk (*) indicates that the cover type for the above inventories is the same as the 1988 standard cover types.

^d The use of a code, such as the (A) footnoted, indicates that the code used for the above inventory corresponds to the 1988 standard cover types.

^e The codes that appear in this column are those that are different than the 1988 standard code.

Table 4. Continued.

STATE CODE	COVER TYPES (Standardized in 1988)	UTAH LAKE (66) ¹ BEAR R. (69) WEBER R. (70)	UINTAH (67) W. COLO. (67) VIRGIN R. (78) UINTA B. (80)	SALT LAKE COUNTY (82)	U. SEVIER (81) M. SEVIER (83) L. SEVIER (85) BEAR R. (86) WEBER R. (87)
IA3	Forage Crops	-	-	A	*
IA3a	Alfalfa	A1	A10	-	*
IA3b	Grass-Hay	A3	A12	-	*
IA3c	Grass/Turf	-	-	-	IA3e
IA3d	Pasture	A2	A13	-	*
IA3e	Other	-	A11	-	IA3c
IA4	Other	-	A18	Ai	*
IA4a	Fallow Plowed	-	-	-	*
IA4b	Idle (Overgrown)	A12	A17	-	*
IB	Non-Irrigated	E	B	D	*
IB1	Row & Close-Grown Crops	-	-	-	*
IB1a	Grain (Beans, Seeds)	E1	-	-	*
IB1a1	Wheat	-	-	-	*
IB1a2	Other Grains	-	B2	-	*
IB1a3	Dry Beans	-	B3	-	*
IB1a4	Safflower	-	B4	-	*
IB2	Hayland Crops	-	-	-	*
IB2a	Alfalfa	E2	B1	-	*
IB2b	Pasture	E3	B5	-	*
IB2c	Other	E5	-	-	*
IB3	Other (Plowed)	-	B7	-	*
IB3a	Fallow	E4	B6	Df	*

¹ The data in parentheses (66) identifies the year the field checking was conducted for the various inventories.

² The dash (-) indicates that there was no corresponding cover type mapped for the above inventories.

³ The asterisk (*) indicates that the cover type for the above inventories is the same as the 1988 standard cover types.

⁴ The use of a code, such as the (A) footnoted, indicates that the code used for the above inventory corresponds to the 1988 standard cover types.

⁵ The codes that appear in this column are those that are different than the 1988 standard code.

Table 4. Continued.

STATE CODE	COVER TYPES (Standardized in 1988)	UTAH LAKE (66) ^a BEAR R. (69) WEBER R. (70)	UINTAH (67) W. COLO. (67) VIRGIN R. (78) UINTA B. (80)	SALT LAKE COUNTY (82)	U. SEVIER (81) M. SEVIER (83) L. SEVIER (85) BEAR R. (86) WEBER R. (87)
II	Meadow/Wetlands/Open Water	C	O, F	-	*
IIA	Grassy Aspect	-	-	-	*
IIA1	Irrigated	-	-	-	*
IIA1a	Pasture	-	-	-	*
IIA1b	Hayland	-	A14 A15	-	IIA1a1,2a1 IIA1a2,2a2
IIA2	Non-Irrigated	-	-	-	*
IIA2a	Pasture	C4	8, F8	Ws	IIA1b1,2b1
IIA2b	Hayland	-	-	-	IIA1b2,1b2
IIA2c	Non-Agricultural Use	-	-	-	IIA1b3,2b3
IIB	Cattail/Bullrush	C1	F4	Wc	*
IIC	Wet Flats (barren)	-	-	M	*
IID	Shrub Aspect	C5	F2	-	*
IIE	Riparian	C2	-	Wr	*
IIE1	Forested Aspect	-	F1	-	*
IIE2	Shrub Aspect	C3	3,5,6,7,9	-	*
IIF	Open Water	B	E	-	*
IIF1	Streams	-	-	-	*
IIF2	Reservoirs	-	E1, E2	-	*
IIF3	Ponds/Lakes	-	E4	-	*
IIF4	Other	-	E3	-	*
IIF4a	Temporarily Flooded	-	-	-	*
IIF4b	Sewage Lagoon	-	-	-	*
IIF4c	Evaporation Pond	-	-	S	IIFAC, VC2

^a The data in parentheses (66) identifies the year the field checking was conducted for the various inventories.

^b The dash (-) indicates that there was no corresponding cover type mapped for the above inventories.

^c The asterisk (*) indicates that the cover type for the above inventories is the same as the 1988 standard cover types.

^d The use of a code, such as the (A) footnoted, indicates that the code used for the above inventory corresponds to the 1988 standard cover types.

^e The codes that appear in this column are those that are different than the 1988 standard code.

Table 4. Continued.

STATE CODE	COVER TYPES (Standardized in 1988)	UTAH LAKE (66) ¹ BEAR R. (69) WEBER R. (70)	UINTAH (67) W. COLO. (67) VIRGIN R. (78) UINTA B. (80)	SALT LAKE COUNTY (82)	U. SEVIER (81) M. SEVIER (83) L. SEVIER (85) BEAR R. (86) WEBER R. (87)
III	Range & Forest Land	-	-	-	*
IIIA	Alpine Plants	-	-	-	*
IIIB	Conifer	-	-	-	*
IIIB1	Douglas/White Fir	-	-	Uc	*
IIIB2	Ponderosa	-	-	-	*
IIIB3	Fir/Spruce	-	-	-	*
IIIB4	Lodgepole Pine	-	-	-	*
IIIB5	Pinyon-Juniper	-	-	-	*
IIIB6	Etc.	-	-	-	*
IIIC	Deciduous	-	-	-	*
IIIC1	Aspen	-	-	Ud	*
IIIC2	Mountain Brush	-	-	-	*
IIIC3	Etc.	-	-	-	*
IIID	Grass Aspect	-	-	-	*
IIID1	Dry Pasture	-	-	-	*
IIID2	Native Grasses	-	-	-	*
IIID3	Etc.	-	-	Ug	*
IIIE	Shrub Aspect	-	-	-	*
IIIE1	Northern Desert Shrub	-	-	-	*
IIIE1a	Sagebrush	-	-	Um	*
IIIE1b	Etc.	-	-	-	*
IIIE2	Southern Desert Shrub	-	-	-	*
IIIE2a	Creosote Bush	-	-	-	*
IIIE2b	Etc.	-	-	-	*
IIIE3	Salt Desert Shrub	-	-	-	*
IIIE3a	Shadescale	-	-	-	*
IIIE3b	Greasewood	-	-	-	*
IIIE3c	Saltbrush	-	-	-	*
IIIE3d	Desert Molley	-	-	-	*
IIIE3e	Etc.	-	-	-	*

¹ The data in parentheses (66) identifies the year the field checking was conducted for the various inventories.

² The dash (-) indicates that there was no corresponding cover type mapped for the above inventories.

³ The asterisk (*) indicates that the cover type for the above inventories is the same as the 1988 standard cover types.

⁴ The use of a code, such as the (A) footnoted, indicates that the code used for the above inventory corresponds to the 1988 standard cover types.

⁵ The codes that appear in this column are those that are different than the 1988 standard code.

Table 4. Continued.

STATE CODE	COVER TYPES (Standardized in 1988)	UTAH LAKE (66) ¹ BEAR R. (69) WEBER R. (70)	UINTAH (67) W. COLO. (67) VIRGIN R. (78) UINTA B. (80)	SALT LAKE COUNTY (82)	U. SEVIER (81) M. SEVIER (83) L. SEVIER (85) BEAR R. (86) WEBER R. (87)
IV	Barren Lands	-	-	-	*
IVA	Bare Soil/Sand	-	-	-	*
IVA1	Dry Salt Flats	-	-	-	*
IVA2	Beaches	-	-	-	*
IVA3	Other Sandy Areas	-	-	-	*
IVA4	Other	-	-	-	*
IVB	Rock Outcrop	-	-	Ur	*
IVC	Excavated Land	-	-	E	*
IVD	Other	-	-	-	*
V	Built-Up Land	D	C	-	*
VA	Farmstead	-	-	-	*
VA1	Builds/Homes	-	C1,C5	-	*
VA2	Open Spaces	-	C4	-	*
VB	Residential	-	-	-	*
VB1	High Density	-	C3	Rt,R	VB1,VB2,VB6a
VB2	Low Density	-	-	R1	VB3
VB3	Open Spaces	-	C2	L	VB4
VB4	Idle	-	-	-	*
VC	Commercial/Industrial	F	D	C	*
VC1	Commercial	-	-	-	*
VC2	Industrial	-	-	-	VC4
VC3	Open Spaces	-	-	X	*
VD	Transportation & Utilities	-	-	D	VD,VE
VE	Other	-	-	-	*

- ¹ The data in parentheses (66) identifies the year the field checking was conducted for the various inventories.
- ² The dash (-) indicates that there was no corresponding cover type mapped for the above inventories.
- ³ The asterisk (*) indicates that the cover type for the above inventories is the same as the 1988 standard cover types.
- ⁴ The use of a code, such as the (A) footnoted, indicates that the code used for the above inventory corresponds to the 1988 standard cover types.
- ⁵ The codes that appear in this column are those that are different than the 1988 standard code.

APPENDIXES

APPENDIX A

Hydrologic Inventories

- Utah Lake Drainage Area. In cooperation with Utah State University. November 1969. 136 pages - includes substantial climatic, streamflow, and groundwater data, detailed water budgets, and more general information on water quality, geology, economy, history, and physiography.
- Uintah Study Unit. In cooperation with Utah State University. March 1970. 181 pages - includes substantial climatic, streamflow, and groundwater data, detailed water budgets, and more general information on topography, geology, arable lands, history, economy, water quality and water development and management. (out of print, file copy only)
- Weber River Study Unit. In cooperation with Utah State University. August 1970 - includes substantial climatic, streamflow and groundwater data, detailed water budgets, and more general information on topography, geology, economy, and water quality.
- Great Salt Lake Desert Area. In cooperation with Utah State University. November 1971. 70 pages - includes substantial climatic and water resources data, water budget for Tooele Valley, and more general information on physiography, economy, geology, and water management aspects.
- Bear River Study Unit. In cooperation with Utah State University. February 1973. 126 pages - includes substantial climatic, streamflow, and groundwater data, detailed water budgets, and more general information on water quality, topography, geology, and economy.
- Price River Study Unit. June 1975. Includes climatic, streamflow, and groundwater data, detailed water budgets, and more general information on water quality, topography, geology, and economy.
- Escalante River Study Unit. December 1976. Includes climatic, streamflow, and groundwater data, detailed water budgets, and more general information on water quality, topography, geology, and economy.
- Dirty Devil River Study Unit. January 1977. Includes climatic, streamflow, and groundwater data, detailed water budgets, and more general information on water quality, topography, geology, and economy.
- San Rafael River Study Unit. January 1977. Includes climatic, streamflow, and groundwater data, detailed water budgets, and more general information on water quality, topography, geology, and economy.

Update of the Price River Study Unit. June 1978. Includes updated climatic, streamflow, and water use data and detailed water budgets.

Update of the San Rafael River Study Unit. December 1979. Includes updated climatic, streamflow, and groundwater data, detailed water budgets, and more general information on water quality, topography, geology, and economy.

Virgin and Kanab Study Units (Utah's Lower Colorado River Area). February 1983. Includes climatic, streamflow, and groundwater data, detailed water budgets, and more general information on water quality, topography, geology, and economy.

Hydrologic Inventory of Colorado, Dolores, and San Juan Study Units. September 1987. Includes climatic, streamflow, and groundwater data, detailed water budgets, and more general information on water quality, topography, geology and economy.

Hydrologic Inventory of the Sevier River Basin. January 1991. Includes climatic, streamflow, and groundwater data, detailed water budgets, and more general information on water quality, topography, geology and economy.

APPENDIX B

In late 1984 at the beginning of Division of Water Resource's new phase of mapping water-related land use, an Active Mappers Committee was formed. The Division of Water Resources, Department of Natural Resource and The Division of Agriculture Development and Conservation, Department of Agriculture co-chaired this committee. Lloyd Austin, Division of Water Resources and Jim Christensen, Department of Agriculture filled these roles. Member agencies were:

- Automated Geographic Reference
- Bureau of Land Management
- Bureau of Reclamation
- Center of Remote Sensing, University of Utah
- Dept of Transportation
- Dept of Agriculture
- Dept of Natural Resource
- Dept of Health - Water Pollution
- Div of Water Resources
- Div of Water Rights
- Div of Wildlife Resource
- Soil Conservation Service
- State Lands and Forestry
- Utah Geological and Mineral Survey
- U.S. Fish and Wildlife
- U.S. Forest Service/Ogden
- U.S. Forest Service
- U.S. Geological Service
- Utah State University-Extension Service

The committee surveyed all ongoing mapping efforts and then focused on the issue of coordinating and standardizing map data. The relationships between several state agencies and the AGRC program of the Office of Planning and Budget were also clarified. Three specific products came from this committee's work. The first was a standardized definition of a base resource data map file as follows:

<u>Layers of Data</u>	<u>Level of Detail</u>
Infrastructure & Base	Map Quad Sheet (USGS Topo) 1:24,000 scale
Ownership	Federal/State/Private, input 1:250,000 scale
Soils	Level 3 definition with preferred input of 1:24,000 scale
Land Cover	Use standard legend and set preferred input 1:24,000 scale
Climate	Precipitation/Temperature 1:250,000 input scale

Secondly, a standard legend for a cover map was developed and agreed upon which allows a hierarchy of data entry. This is shown as Table 1. The headings which are marked with an asterisk were minimum required for the base data set. Individual agencies could use finer breakdowns as needed for their specific programs.

The Division of Water Resources used only certain categories in the Cedar/Beaver Basin mapping which were considered necessary for water use budgets being prepared. All range land and forest land categories were left off while some categories were subdivided further than required by the base data set standards.

The third agreement reached by the committee was the use of a standard set of watershed units for the state. It was agreed that the maps developed by the United States Geological Survey working with National Water Resources Council would serve as the base standard. Individual agencies could then further subdivide these larger units for specific study purposes. This proposal was also presented to the Resource Development Coordinating Committee during the year 1986 and ratified.

APPENDIX C

Water-Related Land Use Studies

- Utah Lake Drainage Area. In cooperation with Utah State University. February 1968 - detailed water-related land use tables and maps.
- Bear River Drainage Area. In cooperation with Utah State University. April 1969 - detailed water-related land use tables and maps.
- Weber River Drainage Area. In cooperation with Utah State University. February 1970 - detailed water-related land use tables and maps.
- Uinta Hydrologic Area. Staff Report No. 7. September 1971 - detailed water-related land use tables and maps.
- West Colorado Hydrologic Area. Staff Report No. 8. January 1972 - detailed water-related land use tables and maps.
- Uintah Basin. In cooperation with U.S. Soil Conservation Services and National Aeronautics and Space Administration. 1980. Contains detailed water-related land use maps and tables. Investigates the use of landsat data concurrently with the high altitude color infrared photography to update the changing patterns of land use. Performed under contract with the Center for Remote Sensing and Cartography of the University of Utah Research Institute. 109 pages plus maps.
- Sevier River Basin (Upper Portion), 1981. Contains detailed water-related land use maps and tables. Performed under contract with the Center for Remote Sensing and Cartography of the University of Utah Research Institute. 27 pages plus maps.
- Sevier River Basin (Lower Portion), 1985. Contains detailed water-related land use maps and tables.
- Salt Lake County, 1982. Contains detailed water related land use maps and tables. Performed under contract with the Center for Remote Sensing and Cartography of the University of Utah Research Institute. 24 pages plus maps.
- Sevier River Basin (Middle Portion), 1984. Contains detailed water-related land use maps and tables. Performed under contract with the Center for Remote Sensing and Cartography of the University of Utah Research Institute. 34 pages plus maps.
- Virgin River Area, 1989. Contains detailed water-related land use maps and tables. Performed in cooperation with USDA Soil Conservation Service, St. George, Utah office and Utah Division of Water Rights, Cedar City Area Office. 56 pages plus maps.

Bear River Basin, 1991. Contains detailed water-related land use maps and tables. Performed in cooperation with Utah Division of Water Rights. 50 pages plus maps.

Columbia River Basin (Utah portion), 1991. Contains detailed water-related land use maps and tables. 46 pages plus maps.

Southeast Colorado Basin (Utah Portion), 1991. Contains detailed water-related land use maps and tables. 57 pages plus maps.

Sevier River Basin, 1992. Contains detailed water-related land use maps and tables. 136 pages plus maps.

Weber River Area, 1992. Contains detailed water-related land use maps and tables. 56 pages plus maps.

Kanab Creek/Virgin River Study Units, 1992. Contains detailed water-related land use maps and tables. 58 pages plus maps.